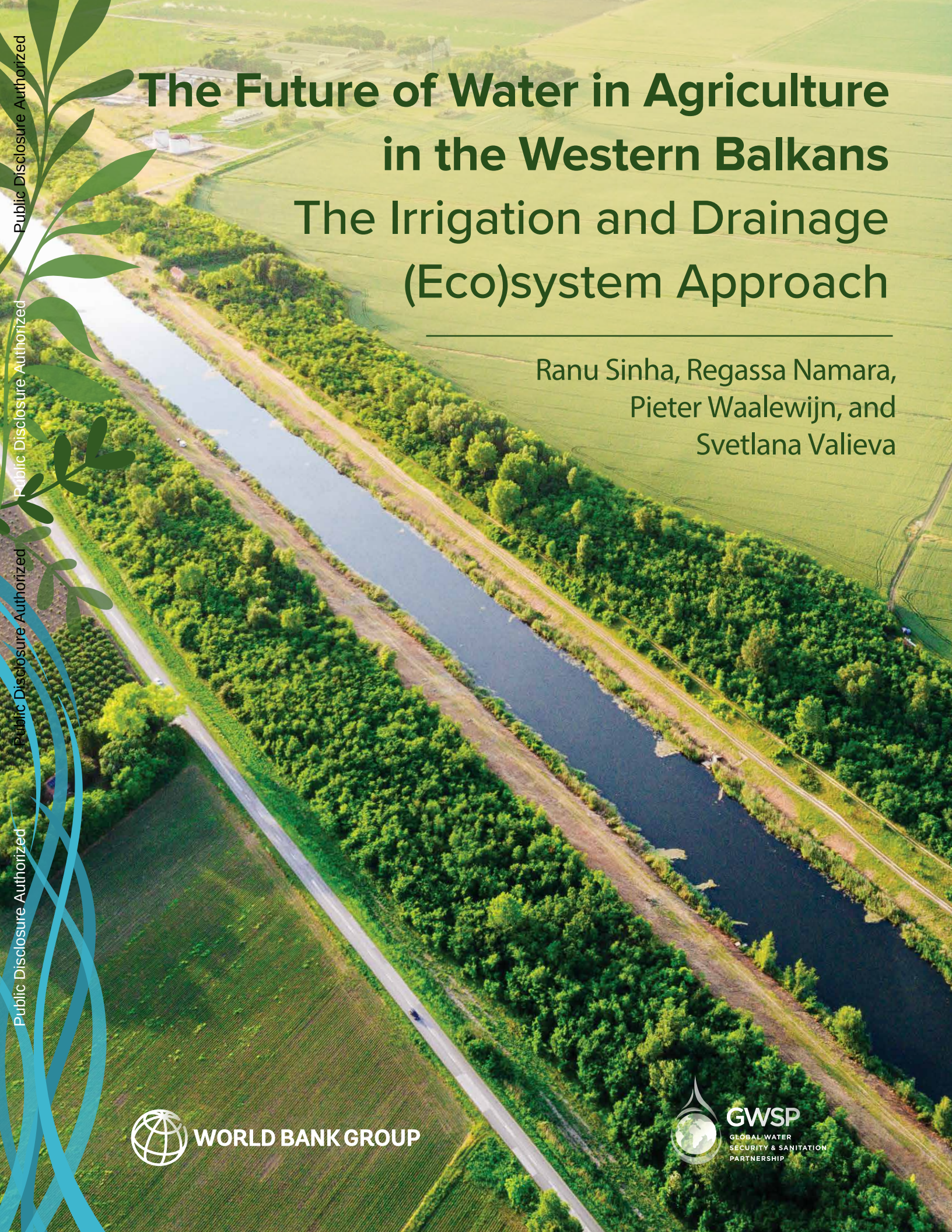
The Future of Water in Agriculture in the Western Balkans

The Irrigation and Drainage (Eco)system Approach

Ranu Sinha, Regassa Namara, Pieter Waalewijn, and Svetlana Valieva



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WORLD BANK GROUP

1818 H Street NW, Washington, DC 20433

Telephone: 202-473-1000; Internet: www.worldbank.org

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EXECUTIVE SUMMARY

Since the early 1990s, with the support of the World Bank and other donors, governments in the Western Balkans have invested significantly in the irrigation and drainage (I&D) sector, resulting in an increase in the amount of irrigated area—with the purpose of accelerating agricultural productivity across the region.

The Western Balkan countries—currently Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia, and Serbia—are in a process of transition driven by factors including climate change; accession to the European Union (EU) and harmonization with the EU's Water Framework Directive (WFD), Green Agenda, and related directives; and a process of structural transformation in the agricultural sector.

This region is characterized by climatic diversity, with four distinct agroclimatic zones that influence agricultural productivity. There are also various types of farms, with three main types of agricultural producers: (1) small household farms; (2) medium mixed-income farms; and (3) larger full-time commercial farms. **The transition this region is undergoing demands a major rethinking of the overall institutional, policy, regulatory, financial, and behavioral aspects of the I&D sector for rural economic revival and transformation.** To enable this transition, the World Bank is uniquely poised to support national governments in rethinking the approach of the I&D sector to accelerate sustainable, green I&D development.

The World Bank's rich history of engagement in the I&D sector across the region has resulted in important lessons learned. The most important of these are to:

- **Break the rehabilitate/dilapidate/rehabilitate cycle;**
- **Ensure optimal use of the I&D potential created; and**
- **Respond to economic, environmental, and social inclusion goals.**

There is a need to *build upon* previous infrastructure investments to embrace a farm-centered investment strategy known as the Irrigation and Drainage (Eco)system approach. This approach customizes both I&D infrastructure ***and*** non-infrastructure investment solutions to meet the diverse water use needs of the various farming systems in the region; address the environmental impacts of increased irrigation intensity; and enables

governments to transition towards a climate resilient I&D sector. However, it does not propose a wholesale alternative to an infrastructure-based investment strategy; rather it builds upon it, and strives to put the sector on a more sustainable development path.

Economic analyses show that new public irrigation systems, whether they are open or pressurized, will only be profitable with a high level of uptake, and a substantial share of users opting to grow high-value crops; but experience in this region has shown that these conditions are often not met in practice. Ensuring the efficient and sustainable use of created potential requires adopting a holistic approach to irrigation modernization; attention to customized irrigation water services, information management, institutional accountability; and diversified financial sustainability models in the region. As a farmer-centric investment model, the I&D (eco) system approach, that is proposed in this study, considers from the outset how farms go about accessing irrigation water; considers their existing crop choices and how they access agricultural markets; accounts for growing climatic threats to irrigated agriculture; and seeks to reduce environmental damage from increased irrigation. It recognizes the need to embed I&D infrastructure investments in a wider basin context and a broader water security and climate resilience agenda, while also acknowledging the additional demands on improving water productivity to reduce negative externalities (such as pollution), and the need to better manage risks. **The desired outcome from an I&D (ecosystem) investment strategy is more sustainable, greener, more climate resilient, and more inclusive rural development.**

This paper provides recommendations for operationalizing the I&D (eco)system approach through six areas of implementation:

1. Strengthening irrigation service delivery; enabling multiagency integration; and enhancing accountability and autonomy of the service provision chain through a clear separation of functions.

2. Greening and decarbonizing irrigated agriculture by adopting a “circular economy” approach, promoting the recycling and reuse of resources, and promoting renewable energy use in I&D.

3. Scaling up farmer-led irrigation development.

4. Accelerating investments in markets and value chains for climate resilient and higher-value crops.

5. Revitalizing I&D “climate-smart” infrastructure solutions.

6. Investing in basin-to-farm hydrological and agrometeorological climate services.

To illustrate how this approach could be applied in a country context, the (eco)system investment approach is presented in the context of a potential multi-Global Practice (GP) operation by the World Bank in Albania.

ABBREVIATIONS

BiH	Bosnia and Herzegovina
CAHMP	Central Asia Hydrometeorology Modernization Project
CAP	common agricultural policy
EIRR	economic internal rate of return
ET	evapotranspiration
EU	European Union
FBiH	Federation of Bosnia and Herzegovina
FLID	farmer-led irrigation development
FLL	field-level leadership
GDP	gross domestic product
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	greenhouse gas
GIS	geographic information system
GP	global practice
GRID	Green, Resilient, and Inclusive Development
HVC	high-value crop
I&D	irrigation and drainage
ICT	information and communication technology

IDU	irrigation and drainage unit
IFAD	International Fund for Agricultural Development
IPARD	Instrument for Pre-Accession Assistance for Rural Development
ISF	irrigation service fee
IWC	irrigation water community
IWRM	integrated water resources management
LLC	limited liability company
LPIS	land parceling information system
LVC	low-value crop
MIS	management information system
MOM	management, operation, and maintenance
MSP	multi-stakeholder platform
PIM	participatory irrigation management
PPP	public-private partnerships
RS	Republika Srpska
SCADA	Supervisory Control and Data Acquisition
SIDA	Swedish International Development Cooperation
SIIP	Sahel Irrigation Initiative Project
SOC	soil organic carbon
SPS	sanitary and phytosanitary
UNDP	United Nations Development Programme
WBGF	Western Balkans Guarantee Facility
WFD	Water Framework Directive
WP	water productivity

WRIP	Water Resources and Irrigation Project
WUA	water users association
WUC	water utility company
WUE	water use efficiency
WUO	water user organization

1

Introduction

The Western Balkans are among the best-endowed regions of Europe in terms of land, soil, water, and labor resources. The region therefore holds significant potential for improving its agricultural productivity if the right mix of investment models, policies, strategies, and actors are engaged in the irrigation and agriculture sectors. These countries are endowed with relatively abundant water resources; however, these resources are highly seasonal and spatially diverse, making irrigation and drainage (I&D) indispensable for productive and sustainable regional agricultural development. They are also characterized by economies in transition and rapidly changing demographics, along with increasing urbanization. However, the economies are hampered by inefficiencies; consequently, much needed agricultural productivity gains have not materialized, and countries in the Western Balkans are far from reaching their potential.

With diminishing opportunities, increasing competitiveness, and falling incomes, agriculture tends to become an economic activity of last resort, providing critical income only to those without other job opportunities. Modern irrigation is a critical element for managing the risks associated with climate change, and for helping agriculture producers to increase crop productivity and diversification in a sustainable manner. Yet, in several of the Western Balkan countries, irrigation development is at its historic low both in terms of investment, and in terms of irrigated area, and has declined to values below the European Union (EU) average. Drainage plays an equally important role in extending both the cropping area and the cropping season; but this also remains underdeveloped or poorly maintained in many places.

Agriculture is in a process of structural transformation, and greater efficiencies are being sought; this highlights the importance of improving I&D in this region. The Western Balkans have a rich agricultural history; as the region has developed economically over the years, this has coincided with growth in the sector. In all Western Balkan countries,

the agricultural sector is dominated by small family farms, with some large holdings owned and managed by individuals, as well as enterprises or cooperatives. Thus, it is critical to develop I&D capabilities in the region to reduce the variability of the availability of water resources over space and time. Enhancing I&D also enables countries to adapt and align to the EU's regulatory frameworks, optimize farm productivity, and enhance the competitiveness of the agricultural sector. Increased agricultural competitiveness may also catalyze new opportunities for small and medium farms in the region to transition to more productive commercial farms. However, the agricultural sector has been generally characterized by inefficiencies and low productivity. Most Balkan countries are currently net importers of agri-food products, except for Serbia, which is a net exporter; and many countries in the region are facing rising trade deficits.

The Western Balkan region is characterized by diverse ecological and agroclimatic conditions. As such, agriculture (including both crops and livestock) is practiced within four distinctive zones, each with distinct agroclimatic characteristics. **These countries are in a moment of transition in their development due to the expansion of the EU in 2025, particularly because this may enhance market and financial opportunities.** With the announcement of the next round of EU accession negotiations, which will provide greater access to a market with more than 500 million consumers as well as greater freedom of movement of capital and labor, the Balkan countries are at crossroads in their development trajectory. However, the EU also imposes stringent standards. Thus, the pre-accession period provides an opportunity to prepare for the fierce competition that these countries will face in the EU single market. Other potential market opportunities include emerging countries within the Middle East and Asia, to which the Western Balkan countries could seek access based on their comparative advantages. Although each of these countries has contextual differences and diversity in terms of their water endowments and agricultural sector maturity, policymaking in general has been dictated by *ad hoc* considerations and has lacked orientation toward the EU's regulatory and policy mandates for water and agriculture (Volk et al. 2010). This has recently started to change, as all the countries are coming to recognize the importance of aligning their policies with the EU. Overcoming these constraints and setting the conditions for harmonized cross-sectoral policies, however, sharpens the importance of an integrated regional approach to tackling the constraints to agricultural growth.

This study supports the World Bank's irrigation and agricultural sector clients in the Western Balkans region, especially regarding transitions and opportunities for the agricultural sector. For the purposes of this analytical report, the Western Balkans region includes Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, and North Macedonia[1] (map 1.1). The report aims to consolidate disparate analyses conducted at

MAP 1.1 Regional map of the Western Balkans

Source: World Bank.

the national level on subthemes including climate change, agriculture, the environment, structural transformation, and the regional drivers of transition. It also presents strategies and implementation areas that are designed to meet the needs of diverse farming systems and to customize interventions in I&D development and management approaches in the region, based on diverse climatic, geographical, financial, and infrastructure contexts.

Since the early 1990s, the World Bank has been supporting irrigation development in the Western Balkans. This rich experience has exposed the need to broaden I&D reform to include aligning investments in such a way that they meet the needs of the diverse farming systems in the region in a holistic and integrated manner. Irrigation systems are sociotechnical systems embedded in natural, social, and economic settings (Molden 2007). To ensure the optimal use and impact of irrigation investments, special attention should be paid to coordinating the interaction ***among*** these factors. However, thus far the

conventional investment model in the I&D sector has placed emphasis on the infrastructure needs of dams, canals, and distribution facilities for achieving improvements in agricultural productivity, food security, and water security. The result is that despite some progress made, the predominant focus on investing in the rehabilitation of dilapidated irrigation infrastructure has not allowed for sufficient consideration of changing agricultural markets, the growing climatic threats to irrigated agriculture, the socioeconomic needs of diverse farming systems, and the "social" infrastructure represented by institutions (that is, water users) in the Western Balkans. The irrigation sector therefore is not optimally organized and managed in such a way as to effectively address today's challenges of transitioning toward greener economies and the broader sustainability and resilience agenda for most of the Balkan countries.

It is important for all governments across the Western Balkans to start devising comprehensive investment in sustainable I&D management and recognize the need to embed investments in a wider basin context, as well as the wider natural, social, and economic systems to which it contributes. This places additional demands on improving irrigation service delivery for new types of farmers; adaptation to the diversity of farming systems in the Western Balkans; and reduction of the environmental externalities of increased irrigation within a river basin. It also points to the need to improve water use efficiency, and to better manage climate risks to both the infrastructure and users. **This requires a fundamental rethinking of the I&D investment strategy.**

The *I&D (eco)system approach* places farms at the center, for a more integrated and holistic framing of investment interventions, by customizing irrigation planning to meet the water use needs of diverse farm realities. It aims to shift investment toward a farm-centric approach in two ways that are distinctly different from "business as usual." First, it has a "customized" approach to selecting I&D infrastructure and non-infrastructure solutions based on the objectives and interests of both male and female farmers across all three farm types in the region. Secondly, it places strong emphasis on "environmental stewardship," which means that interventions in modernizing I&D infrastructure must be coupled with the required processes of resource and service provision and resource transformation; this in turn must consider the needs of the environment.

This shift in investment thinking for the I&D sector directly aligns with the World Bank's Green, Resilient, and Inclusive Development (GRID) framework[2] and the EU's green recovery policy priorities for the Western Balkans. Thus, **this report recommends that future irrigation interventions and management strategies take an integrated and holistic approach to designing, implementing, and monitoring investments in the I&D sector.**

STRUCTURE OF THE PAPER

Chapter 2 presents the broader transitions that are underway across all the Balkan countries and the unique constraints and challenges they present to the I&D sector. Chapter 3 discusses the structural dimensions of the ongoing transformation in the agricultural sector across the Western Balkans; describes the four agroclimatic zones, and the three main types of farms; and identifies the major constraints and opportunities for the I&D sector in supporting this structural transformation. Chapter 4 presents a variety of irrigation infrastructure types that are common to the region, and highlights gaps in the development of I&D infrastructure, as well as the tariff systems, water allocation, and government support mechanisms. It also presents some lessons learned from past World Bank engagements. Chapter 5 presents and defines the irrigation and drainage (eco)system approach and discusses the six recommended implementation areas tailored to the Western Balkans' diverse farm types, agroclimatic zones, and distinct transition requirements. In concluding, chapter 6 summarizes the key takeaway messages and presents recommended actions.

NOTES

1. For the purposes of this paper, Croatia, which is normally not included in the Western Balkans, is included as one of the countries. The term "Western Balkans" is used in various ways in different contexts. For many years it was the main label used for the accession dialogue between the EU and Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia, and Serbia. Since Croatia joined the EU and therefore left this accession group, it is sometimes referred to as part of "South-East Europe" rather than the Western Balkans. However, South-East Europe also includes Greece, Bulgaria, Romania, and part of Turkey; therefore, "Western Balkans" remains the most precise term for the area covered by this study.

2. The forthcoming World Bank Group Corporate Climate Change Action Plan Strategy for 2021–25 will present a paradigm shift of the World Bank toward a Green, Resilient, and Inclusive Development (GRID) approach, which is an interlinked approach to responding to the triple crises of poverty, climate change, and inequality.

2

Drivers of Transition for the Irrigation and Drainage Sector in the Western Balkans

This chapter presents three of the major drivers underpinning and driving transition in the irrigation and drainage (I&D) sector of the Western Balkan countries. It also highlights specific emerging constraints and discusses implications for the future of the I&D sector in the region.

The three main drivers are (1) accession to the European Union (EU), and the EU Green Agenda; (2) climate change; and (3) structural transformation of the agricultural sector.

ACCESSION TO THE EUROPEAN UNION AND THE GREEN AGENDA

After the breakup of the Soviet Union in the Western Balkans in the 1990s, the economies of the Western Balkan countries have followed a path of economic liberalization and integration into the European Economic Community. The formal breakup of Yugoslavia began in 1991, when Slovenia and Croatia declared independence. There was a period of conflict before this independence was recognized by the international community and the rest of Yugoslavia. Each former Yugoslav Republic was initially granted access to the EU market through "autonomous trade preferences," through which the EU granted unlimited tariff-free access for most goods without limit, and set tariff quotas for some sensitive products such as wine, beef, lamb, and mutton.[1] These were progressively replaced by negotiated stabilization and association agreements, under which these territories had to grant trade concessions to goods coming from the EU and commit to a process of political and economic integration into the Europe Union.

All the Western Balkan countries are now in the process of harmonizing with the EU, which requires them to adapt to the EU's institutions, directives, and regulatory policies. All of them have initiated an accession dialogue with the EU; Croatia completed the process and became a member state in 2013. As each country prepares for their potential accession to the EU, regardless of their country-specific diversities of natural resources and governance systems, they are required to adopt and align with all aspects of the EU's *acquis communautaire*,[2] with the division between "community competence" and "national competence" varying from sector to sector. Agriculture, rural development, and water resource management are strongly integrated at the EU level through the EU Common Agricultural Policy (CAP) and the Water Framework Directive (WFD), which deals with water quality while leaving quantitative issues up to individual member states and existing international agreements. In addition, part of the accession process is the provision of EU development grants, which are already playing a significant role in Croatia, and will become increasingly important for other countries as they progress along the accession path. In some countries, these grants are being used to support investments in irrigation systems and on-farm irrigation equipment to increase competitiveness and support adaptation to the new water management regulations and standards. The WFD and the newly approved Green Deal and its related directives are highly relevant for the I&D sector in the Western Balkans.

One major milestone of EU accession for the Balkan countries is harmonization with the WFD, which the EU adopted in 2000. The WFD introduces the principle of integrated water management on a basin scale and establishes criteria for environmental protection and the management of water quantity and quality. The countries in this region are at different stages of harmonization with this directive, the practical implementation of which is quite demanding. Table 2.1 gives an approximate summary of the current degree of harmonization

TABLE 2.1 Degree of harmonization with the Water Framework Directive, by country or entity

Country or entity	Degree of harmonization
Albania	High
Federation of Bosnia and Herzegovina	Low
Republika Srpska	Medium
Croatia	Complete (accepted by EU)
Kosovo	Medium (49%)
Montenegro	Medium (25%)
North Macedonia	High
Serbia	High

Source: Goss et al. (forthcoming).
Note: EU = European Union.

for each country or territory. The data shows that all of the countries have adopted legislation on Integrated Water Resources Management (IWRM), which involves at least some of the key principles of the WFD. However, in many cases, the extent of harmonization has been limited by the lack of institutional capacity to implement certain aspects of the directive. In addition, a new EU regulation on treated wastewater reuse for irrigation entered into force in 2020. This regulation addresses harmonized minimum water quality requirements for the safe reuse of treated urban wastewaters in irrigated agriculture[3]; it can also present new opportunities to explore renewable sources of water for irrigation in applicable Balkan countries.

On October 6, 2020, the European Commission adopted the Economic and Investment Plan for the Western Balkans, mobilizing up to €9 billion of EU funding for the region. This plan aims to spur the long-term economic recovery of the region, support a green and digital transition, and foster regional integration and convergence with the EU. In addition, the Western Balkans Guarantee Facility (WBGF) is expected to mobilize up to €20 billion over the next decade by providing guarantees to help reduce the cost of financing for both public and private investments, and to reduce the risk for investors. This investment package will be a key driver for facilitating increased public and private investments in the region by European and international financial institutions. The plan has identified 10 investment flagships to promote a modern, greener, and more prosperous region in the areas of sustainable transport, clean energy, greening the Western Balkans, the digital future, boosting the private sector, and human capital.

In terms of greening the Western Balkans, the European Commission has presented guidelines to all of the Western Balkan countries for implementation of the Green Agenda. The Green Agenda was adopted, in principle, by all of the Balkan countries in November 2020. This agenda lays out requirements in the following three areas: (1) depollution of air, water, and soil; 2) sustainable food systems in rural areas; and 3) biodiversity and protection of ecosystems.[4] Regarding ***depollution***, the agenda lays out priorities for:

- Modernization of the water-monitoring infrastructure;
- Implementation of the Water Framework, Urban Wastewater, and Extractive Waste Directives;
- Supporting regional and/or bilateral agreements and/or protocols on transboundary water and land-based sources of pollution; and
- Investment in waste and manure management, as well as wastewater treatment plants for the reuse of water in agriculture.

In the area of ***sustainable food systems in rural areas***, the agenda lays out priorities for supporting the alignment of the agri-food and primary production sectors with EU standards for:

- Food safety and animal health and welfare, including upgrading agri-food establishments;
- Promoting environmentally friendly and organic farming, as well as the reduction of synthetic chemical products used in food production;
- Supporting cooperation among scientific and educational bodies, producers, and processors in the agri-food sector to support the transfer of innovative and environmentally friendly technologies and farming methods;
- Enhancing efforts for sustainable development of rural areas through the modernization of physical assets in the agri-food sector; and
- Supporting economic diversification and improvement of rural infrastructure under the Instrument for Pre-Accession Assistance for Rural Development (IPARD).

The theme of ***biodiversity, and the protection and restoration of ecosystems*** prioritizes the following:

- Developing and implementing a 2030 Biodiversity Action Plan for the Western Balkans;
- Assisting in an analysis of biodiversity benefits of nature-based solutions, and of opportunities for their integration into the development of climate and other plans;
- Strengthening the mechanisms for regional cooperation on conservation of biodiversity, as well as engagement with the United Nations Rio Convention;
- Supporting knowledge exchange among the Western Balkan countries and EU research centers, and exploring options to set up the Western Balkans Biodiversity Information Hub.

Since the Western Balkan countries are in a moment of transition toward EU accession, meeting the objectives of various EU directives and the EU Green Agenda requires rethinking policy, regulatory, and institutional approaches in the I&D sector, as well as in the agricultural sectors. Harmonizing with the EU accession process and the Green Agenda is driving transition in the agricultural and irrigation sectors at different stages across the seven countries. Countries are aligning their policies to the underlying conditions of the Green Agenda through implementation of IPARD,[5] as well as under their own national programs, for example in Serbia.

The Green Deal and the WFD sharply highlight the fact that the I&D sector is central to enabling agriculture in the Western Balkans in order to achieve sustainability in rural food systems. Both sectors are sharply exposed to the effects of climate change and related environmental concerns stemming from water and cropping practices for food production; thus, they need to align with the EU's climate-neutrality commitments. However, it is also important to note that currently the capacity across most of the Balkan countries, at all levels, still must be significantly improved in order to be able to meet the ambitious targets of the EU's Green Agenda. The process of transitioning to green standards and regulations will take considerable time and resources, and will require interventions at the national, subnational, and farm scales across all EU countries.

Agriculture requires large quantities of water to satisfy the increasing demand for high-quality food that meets European standards. However, intensive agriculture often leads to problems such as surface and groundwater pollution, over-abstraction, and inappropriate land management. These challenges endanger the status of the water bodies and the sustainability of water resources, thereby violating several of the commitments of the WFD and related directives (ICPDR 2020). For instance, nutrient pollution has been identified as a significant water management issue in the Danube River basin, of which several Balkan countries are riparian members (ICPDR 2020). Currently, about 20 percent of the surface water bodies are at risk of failing good ecological status/potential by 2021 due to nutrient pollution—and agriculture is a main source of this pollution, along with other sources such as urban areas, or municipal wastewater (ICPDR 2020).

I&D expansion often has varying degrees of negative impact on the environment due to the change in surface water flow regimes. Expansion may also increase the level of pollutants as return flows to rivers, aquifers, and associated ecosystems. The introduction of irrigation often increases the use of agrochemicals, both to support higher production levels and through the new possibilities raised by fertigation. However, across most of the Balkan countries, investments in I&D are rarely coupled with environmental regulations to reduce pollution and avoid damage to ecosystems. Pumped irrigation can also contribute to an increase in greenhouse gas (GHG) emissions, while drainage of wetlands can harm ecosystems and lead to loss of soil carbon. Healthier and more sustainable food production is an essential goal of the Green Deal—and is the first headline target of the European Commission. The World Bank's GRID approach, which is aiming for zero pollution and the creation of a toxic-free environment, is also relevant. These goals require a comprehensive and multipronged policy response that focuses on enhanced pollution monitoring as well as prevention and remediation policies to simultaneously address these challenges. However, few countries in the Western Balkans region have an integrated strategy for how

I&D investments can drive sustainable agricultural growth, and vice versa—that is, how agricultural reforms can drive sustainable and green investments in irrigation.

The countries of the Western Balkans are at a lower level of development than the EU; the current average GDP per capita for the six Balkan countries (excluding Croatia) is only 35 percent of the average of the 28 EU member countries, and just 25 percent of the most advanced Western European countries (Sanfey and Milatovic 2018). This disparity is predicted to get worse if widespread job losses occur in this region due to the ongoing COVID-19 pandemic,[6] thus reducing the amount of food as well as incomes, which can also have an impact on the availability and quality of food. The COVID-19 crisis may force the population to choose cheaper and lower- quality food, with farmers unable to invest in environmentally friendly crop and water use practices, especially in the less developed Western Balkan countries. If the pandemic continues, there is also a threat that other countries will impose export restrictions, which would force some of these countries to rely on their own resources (Matkovski et al. 2020). This may lead some countries into a potential food security problem. The large variability of food supply per capita, which is especially characteristic of Albania, Bosnia and Herzegovina, and Montenegro, indicates that the food market is quite unstable. Thus, potential food shortages resulting from reduced international trade caused by crises can have significant consequences. This is particularly pronounced in countries within the Western Balkans that already have a high level of food supply variability; dependence on cereal imports; and lower per capita GDP. In addition, due to an increasing debt burden on public finances, obtaining adequate budgetary support for the operation and maintenance of irrigation systems may become even harder than usual, thus further disrupting an adequate and timely supply of water for food production.

Much more needs to be done to ensure that the I&D and agricultural sector policies are designed and harmonized in such a way that income losses for farmers are minimized, or compensated for, when measures to protect water bodies and enable green farming practices are being implemented. This insight is driven by recognition that improving the socioeconomic situation in the agricultural sector through investments in I&D for diverse farming systems is a prerequisite for successful implementation of the Green Deal, and the related agro-environmental policies mandated by the EU accession process.

This leads to two major constraints in the current policy, regulatory, and governance landscape of the irrigation and agriculture sectors in the Western Balkans related to the transition toward EU harmonization:

Constraint #1: National policy responses to agriculture and irrigation sector gaps have been fragmented and have not always followed a coherent and integrated strategy across

agriculture, rural development, environmental protection, and irrigation service delivery; and there are limited multiagency coordination mechanisms present across all of these countries. In addition, the EU instruments also lack coordination: for example, in Croatia, investments in irrigation are being carried out by two ministries, using two different EU structural funds, which prevents any technical or regulatory coordination between them.

Constraint #2: Across most of the Balkan countries, investments in I&D infrastructure are rarely coupled with environmental regulations to reduce pollution and avoid damage to ecosystems; and there is a weak focus on incentivizing greener and decarbonized agriculture water management practices.

CLIMATE CHANGE

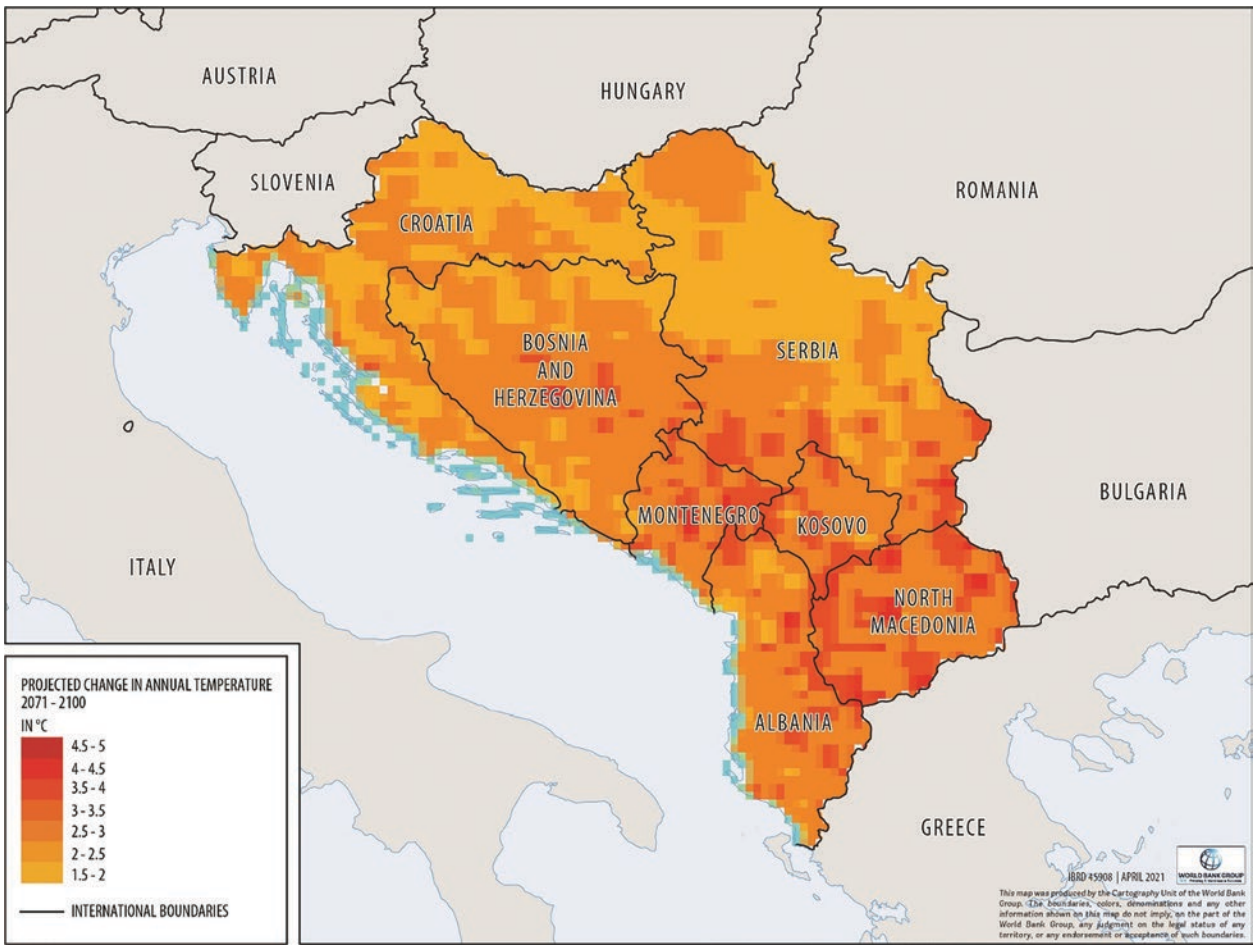
Climate in the Western Balkans varies markedly between countries as well as within the various river basins. The mountainous terrain, and the influence of the Mediterranean and Black Seas create diverse climatic conditions. In general, the climate is characterized by a distinct bimodal seasonality and a strong north–south gradient, with increasing temperature and decreasing precipitation toward the south and southeast; in fact, the south-southeast part of the Western Balkans suffers from prolonged droughts.

Albania has a Mediterranean climate with mild, wet winters and hot, dry summers. The coastal and lowland areas of **Bosnia and Herzegovina** share this Mediterranean climate, while in the remaining areas of the country, climate ranges from temperate continental to alpine. Most of **Croatia** is characterized by a moderately warm, rainy climate. The far north of **Montenegro** has a continental climate, and the central and northern parts have some characteristics of mountain climate, but with Mediterranean Sea influences on temperature and precipitation. The climate of **Serbia** varies from temperate continental in most areas, to continental in the mountains, to Mediterranean subtropical and continental in the southwest. The **Kosovo Plain** has a dry climate with cold winters and very hot summers. Metohija, in the southwest, has a milder climate. The climate zones in **North Macedonia** include sub-Mediterranean, moderate continental, hot continental, cold continental, and a range of alpine sub climates. The upper Vardar Basin exhibits a climate like that of continental Europe, with long cold winters. The area south of Skopje is considered one of the driest regions in North Macedonia.

Climate models predict relatively gradual change up to the middle of the 21st century, after which warming and associated climate changes will accelerate. For 2050 the following changes are expected:

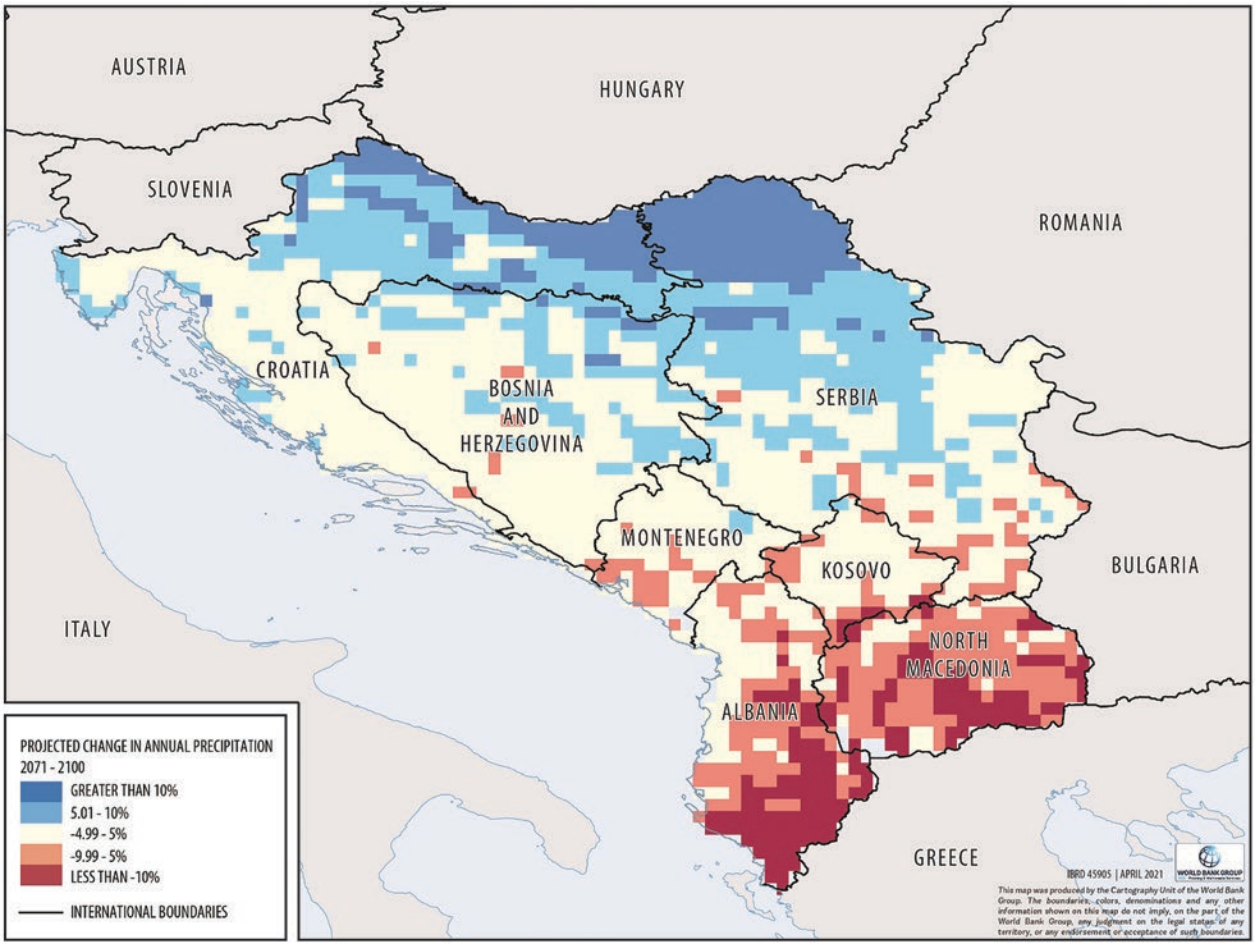
1. ***Average temperatures will rise by 0.5–1.5°C, slightly less in the north and more in the south***. Maximum temperatures will rise, and there will be fewer cold days. With a predicted temperate continental climate, this may lead to increasing snowmelt, resulting in the potential for floods and other related risks (map 2.1).
2. ***The winter season will receive more extreme precipitation, as well as more total accumulated precipitation, with expected "alarming" levels of snowmelt***.
3. ***Precipitation will increase in the north and reduce in the south, with higher precipitation in early spring and late autumn, and lower precipitation in summer***. There will be more drought days (map 2.2).

MAP 2.1 **Projected change in annual temperature in the Western Balkans 2071–2100 Compared to 1971–2000**



Source: Adapted from Globevnik et al. (2018).

MAP 2.2 Projected change in annual precipitation in the Western Balkans 2071–2100 Compared to 1971–2000



Source: Adapted from Globevnik et al. (2018).

4. ***Inflows from the Danube, Sava, Tisa, and Drava rivers will be determined by climate changes further north in Europe; the average flow is not expected to decrease significantly over this period, but flood risk may increase***. Flows for the other rivers will be influenced by precipitation changes within the region, including increased seasonality and variability.

In terms of climate change, the Western Balkans can be divided into three zones:

North (Continental Croatia; Vojvodina; northern half of Bosnia and Herzegovina): Moderate increase in temperature (3.2–3.4°C by late century); and increase in rainfall (10–20 percent rise by late century).

Central and northern coast (Adriatic Croatia; Central Serbia; southern half of Bosnia and Herzegovina; Montenegro; Kosovo): Higher increase in temperature (3.5–3.6°C by late century), no major change in rainfall.

South (Albania; North Macedonia): Highest increase in temperature (3.6–3.7°C by late century) and decrease in rainfall (5–10 percent less by late century). Taking Albania as an example, we know that while annual average precipitation is currently about 1,485 mm/year, only 20 percent of this occurs during the summer months, which makes irrigation during summer indispensable (4,000–5,000 m^3/hectare consumptive use); also, drainage and protection against flooding in winter becomes essential. Climate change is predicted to exacerbate this seasonality problem, as temperatures will increase, and precipitation will decline in the summer months relative to current conditions. (The summer temperatures are predicted to increase by 4–5°C in the northern mountains of Albania). Flooding is especially problematic in the spring when it can delay or prevent the planting of summer crops; climate change can potentially increase the frequency and magnitude of flooding.

The complex nature of these climatic changes in temperature and rainfall will affect crop yields and livestock growth, and will present various threats for farming, such as the rise of pests and crop infections. These threats are still largely unknown at this stage. This leads to the identification of three more major constraints across many of the Balkan countries. That is, the way climate information is collected and used to enable water managers and water users to adapt their irrigation, drainage, and agricultural production patterns to meet the challenges derived from the predicted climate change impacts.

Constraint #3: National hydrometeorology services across the Western Balkans have limited accuracy and timeliness, and limited ability to observe, forecast, and provide the real-time precipitation, temperature, wind pressure, humidity, and river flow data services needed to help irrigation service providers design infrastructure, and deliver water and climate services to end users; and to enable producers to adapt to future climate change risks from changes in temperature and rainfall.

Constraint #4: Across many of the Western Balkan countries, irrigation service providers have limited awareness of the water consumption patterns of farmers using various irrigation techniques (for example, flood irrigation vs. drip irrigation), as well as under different climate scenarios for different crop types. This means that irrigation agencies often cannot develop irrigation management, operation, and maintenance (MOM) plans that are compatible with river flow fluctuations and changes in farmer demand due to cropping needs. In addition, there is very limited spatial planning, and limited crop suitability analysis carried out to support diversification strategies; thus, there is also a need for detailed soil mapping to be

developed to improve the efficiency of I&D services, and related agencies in the agriculture sectors. **Considering the water requirements of various crops, and the soil water status for irrigation scheduling is an important step toward sustainable water resource management.**

Constraint #5: Most farmers across the Western Balkans are rarely able to measure at the on-farm scale (1) how much water they use from crop to crop; (2) how much water they use from season to season; and (3) how their water consumption changes from one irrigation method to another (for example, from flood to sprinkler irrigation).

These hydroclimatic information gaps call for reforms in how the Balkan countries collect and use hydrological and crop/water data. This will also require water resource departments and irrigation agencies to develop and improve I&D systems in such a way as to minimize or avoid system losses; improve monitoring and modelling of surface river flow and underground watercourses; improve river management; and protect vulnerable areas from flooding, where applicable. Specifically, crop-water data collection needs to become more inclusive and adaptive to ensure that the demand data is disaggregated across water sources, types of crops, types of on-farm irrigation methods, and by gender; enabling more nuanced information about the differences in water-use for farming between men and women to be gathered and shared among responsible authorities.

STRUCTURAL TRANSFORMATION IN AGRICULTURE

Over time, agriculture's contribution to total GDP in the Western Balkans is predicted to decrease from a range of 10–23 percent, a trend already underway as other sectors of the economy grow. Currently in the Western Balkan countries, 20–60 percent of the workforce is employed in agriculture. This rate reflects considerable underemployment due to few available opportunities outside of the agri-food sector. As off-farm opportunities increase, the percentage of the workforce in agriculture will decrease, probably ending up closer to the Southern European average of less than 15 percent (Lampietti et al. 2009). The rural population accounts for about 45 percent of the total population in the Western Balkans, compared with 35 percent in Southern Europe. In addition, most employment in agriculture is unpaid family work, contributing to income poverty in rural areas, and migration toward urban centers and abroad.

Demographic change is an important part of agricultural dynamics in the Western Balkans: it is affecting rural land use, ownership, the development of irrigation, and the

gender dynamics of farming communities. The following demographic trends have been observed in the Balkan countries, where agricultural worker wages are lower than average wages in other sectors: (1) migration toward urban areas, and to formal employment in other sectors; (2) seasonal workers moving toward seasonal jobs outside of agriculture (for example, tourism in Montenegro and Albania); and (3) seasonal workers moving toward seasonal agricultural jobs in EU countries where the workers receive relatively higher wages (for example, fruit and vegetable harvesting jobs in Germany and Italy) (World Bank 2018).

One of the potential consequences of outmigration from rural areas is that it may leave many of the smaller farms to be run by women and elderly people, as the younger men go to seek employment in the cities and in other countries. This is particularly important for the I&D sector, since the development of irrigation infrastructure requires that special attention be paid to the role of women and the elderly in agriculture, and their active participation in the planning and decision-making processes be ensured. As male family members migrate, women are more likely to be the decision makers and irrigation managers on irrigated farms in the Western Balkans. This is particularly relevant in countries where there is a predominance of greenhouses to produce high-value crops, and where women are the ones responsible for variety selection, water and crop management, grading, and value addition. When there are absentee male household members, women's responsibilities quite naturally multiply; however, current agricultural extension and infrastructure investment policies rarely target women or engage them directly. Therefore, support to female farmers will require a focused approach to support women in overcoming traditional stereotyping of roles in farming communities in the Western Balkans.

Overall, the agricultural sector in the Western Balkans is transforming, and more coordinated value chains are being developed. High-quality, low-cost agricultural imports are increasing, favored by consumers who have rising incomes and changing preferences; however, the prolonged COVID-19 pandemic crisis could dampen these demands. Integrated value chains that can respond to market demand are now needed for farmers in the Western Balkans to stay competitive. Without value chains as efficient as those of their foreign competitors, costs will be too high, and products will be squeezed out of the market. Producers, processors, and retailers will all need to coordinate their activities more efficiently to minimize transaction costs. This means improving logistics, organization, and links within the value chain. Meanwhile, aligning with EU standards requires better food safety and quality standards, and increasing investment and consolidation in the retail sector is pressuring producers to provide more consistent and more reliable supplies of safe, high-quality products as countries further align with the EU requirements for accession.

Although agricultural sector dynamics are an important driver of I&D development, and a critical element in the inclusion and jobs agendas in rural areas, there is currently weak alignment in both the agricultural and I&D sectors. The agricultural sector and its related dynamic changes, which are present across all of the Balkan countries, are an important driver of I&D. However, there is weak alignment of I&D investment in the sector dynamics, and limited understanding of how to meet the diverse constraints of the various types of producers. This leads to the identification of four more major constraints in the way the I&D infrastructure is designed, as well as to the way agricultural knowledge, extension, and marketing is targeted toward diverse producer groups in the Western Balkans.

Constraint #6: **Weak market integration** for many--mainly small--agricultural producers; weak or nonexistent farm advisory services; and ineffective dissemination of agricultural knowledge that fits the needs of different farm sizes and production profiles.

Constraint #7: **Weak governance, as well as service delivery** functions of key irrigation and water management agencies, which for the most part are not well aligned to the needs of various sizes of farms (for example, small household farms vs. medium-sized production units).

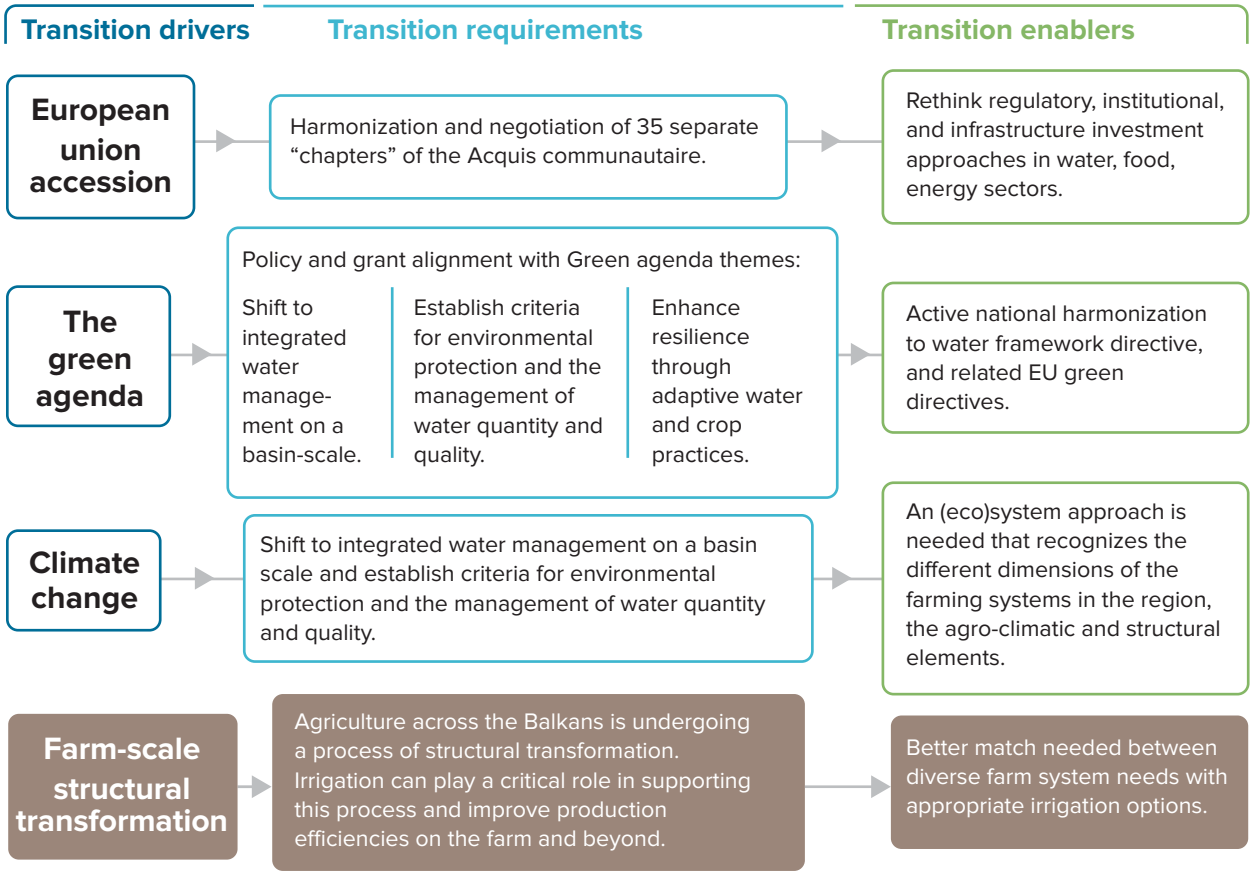
Constraint #8: **A legacy of malfunctioning or completely nonfunctional I&D infrastructure**, for example in the case of the systems constructed during the socialist era; and underfunding of I&D systems O&M due to a combination of low tariffs and low service fee collection rates, which are not targeted to meet the diverse irrigation needs of various types of farmers.

Constraint #9: **Nonexistent targeting of farm advisory services toward small producers, women decision makers, and other groups** on topics such as environmental stewardship, green agricultural practices, biodiversity knowledge, and climate resilient water and cropping practices.

Figure 2.1 summarizes the main drivers that have been mentioned in this chapter; they are driving the transition and the reform needed for the Balkan countries to transform their I&D sectors so that they can meet their overarching objectives for agriculture and economic growth. The next chapter dives deeper into details of the specific structural transformations that are underway in the agricultural sector; the types of farms and the needs of various farming groups in these countries; and identifies why these diverse transitions must be considered when designing the next generation of I&D sector reforms and investments across the Western Balkans.

FIGURE 2.1 Summary of the major drivers of transition in the Western Balkans

The Western Balkan countries are in a process of transition driven by the accession to the EU, the Green Agenda and climate change.



Source: Authors.
Note: WB = Western Balkans; EU = European Union.

NOTES

1. Slovenia, Croatia, and North Macedonia left Yugoslavia before the formation of the European Union; therefore, their initial trading arrangements were with the European Economic Community.
2. The term *acquis communautaire* refers to the whole set of legislation, systems, and procedures on which the EU operates.
3. See more here: https://ec.europa.eu/environment/water/reuse.htm#:~:text=The%20new%20Regulation%20on%20minimum,water%20reuse%20in%20the%20EU.
4. For more information, see: https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/green_agenda_for_the_western_balkans_en.pdf.
5. IPARD is an EU grant program to support potential new member states.
6. Globally, COVID-19 is expected to worsen global food security, and preliminary projections suggest that the pandemic may have added between 83 and 132 million people to the total number of undernourished in the world in 2020, depending on the economic growth scenario (FAO et al. 2020).

3

Structural Transformation of the Agricultural Sector, Agroclimatic Zones, and Dominant Types of Farm Systems in the Western Balkans

STRUCTURAL TRANSFORMATION

The contribution of primary agriculture to the economy in the Western Balkans is relatively small and decreasing. The Western Balkans region occupies a total land territory of about 265,000 square kilometers (km^2), with a population of slightly more than 22 million across seven countries (table 3.1). The contribution of the primary agriculture sector to the overall national economy is around 3 percent for Bosnia and Herzegovina, Croatia, and North Macedonia; 8–10 percent for Kosovo, Montenegro, and Serbia, and a distinct 23 percent for Albania (table 3.1). Except for Croatia, where only 2 percent of the workforce is employed in agriculture, the sector still accounts for an important part of total employment, ranging from 15 percent in Serbia to 38 percent in Albania, while in Kosovo 62 percent of the population is involved in agriculture to some extent. In terms of rural household income, the contribution of agriculture ranges from 3.6 percent in Montenegro and Bosnia and Herzegovina to 7.7 percent in Kosovo; no data is available for Albania. Table 3.1 provides an overview of the importance of agriculture, and a snapshot of the share of irrigated to total arable land across the Western Balkans.

The Western Balkan economies are undergoing a process of structural transformation that has profound implications for the agri-food system and the irrigation sector as well as people's livelihoods and international trade. Structural transformation is defined as the reallocation of economic activity across three broad sectors--agriculture, manufacturing, and services--that accompanies the process of modern economic growth (World Bank 2018).

TABLE 3.1 Importance of agriculture and irrigation in the Western Balkans

	Area	Population	Agriculture's share of GDP (%)	Arable land	Irrigated land	Share of irrigated land to total arable land (%)
Albania	28,750 km²	2,850,000	23	696,000 ha	175,900 ha	25
Bosnia and Herzegovina	51,209 km²	3,790,000	3.3	1,246,000 ha	8,100 ha	0.7
Croatia	56,000 km²	4,100,000	3.7	1,537,000 ha	18,800 ha	1.2
Kosovo	10,908 km²	1,850,000	10.5	185,000 ha	15,000 ha	8
Montenegro	13,812 km²	630,000	8.0	517,000 ha	2,300 ha	0.4
North Macedonia	25,713 km²	2,080,000	2.9	667,000 ha	73,600 ha	11
Serbia	78,361 km²	7,060,000	7.5	3,294,000 ha	105,000 ha	3
Total	**264,806 km²**	**22,360,000**		**8,157,000 ha**	**398,700 ha**	**5**

Source: European Commission. Agriculture in Candidates in EU Enlargement (updated March 2019; National Statistics).
Note: GDP = gross domestic product; ha = hectares.

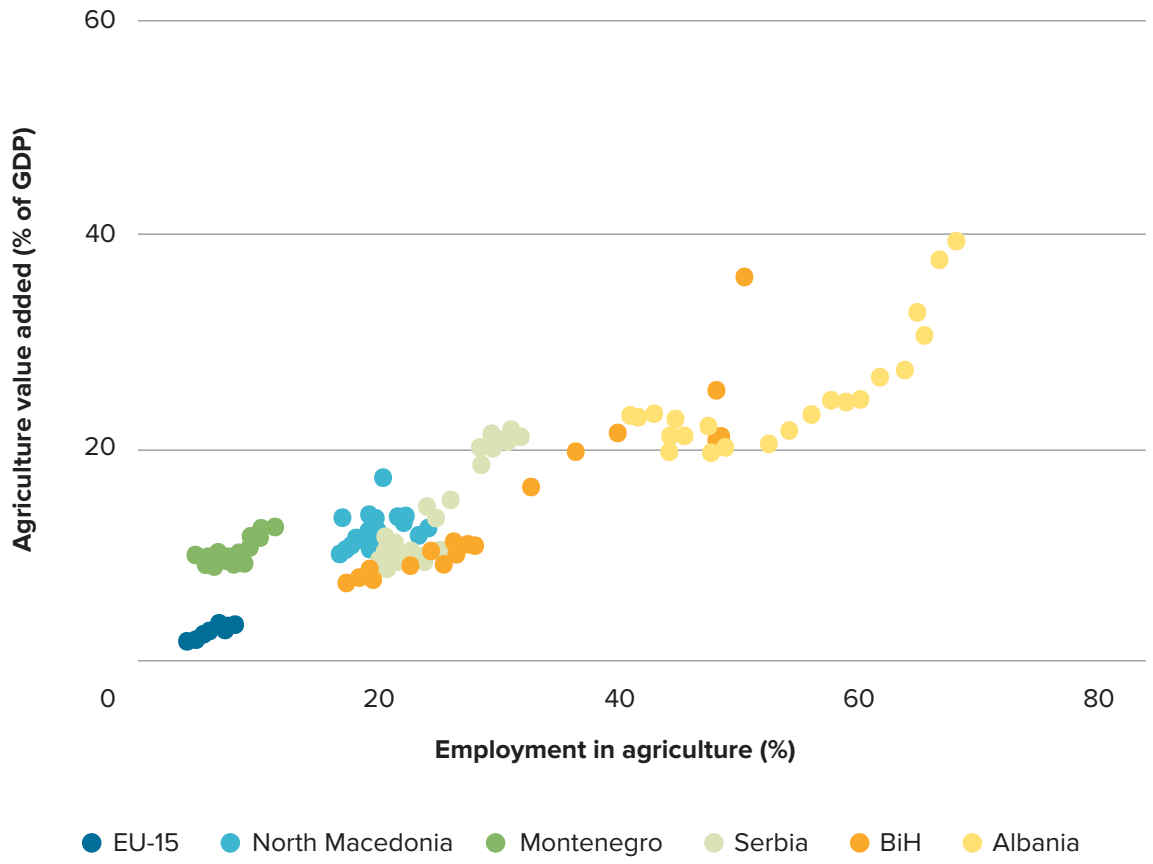
Within agriculture, structural transformation refers to the process of improvements in total factor productivity (land, labor, capital) that are driven by technological change.

Agriculture across the Western Balkans is currently going through a process of structural transformation, marked by the industrialization and modernization of agricultural practices; significant increases in labor productivity across sectors; rural-urban migration; and a reduction in the share of agriculture in total employment and in gross domestic product (GDP) (Bustos, Caprettini, and Ponticelli 2016; World Bank 2018). All of the Balkan countries, however, are classified as "incomplete transformers" because of the relatively low productivity and competitiveness of their agri-food systems, and the high shares of GDP and employment that still depend on the primary agriculture sector, as well as a significant rural-urban divide in regard to income and poverty, and a link between poverty and agriculture in rural areas (World Bank 2018).

The process of structural transformation in the Western Balkans is uneven and incomplete. In 2016, primary agriculture accounted for 40.7 percent of employment and 22.9 percent of the GDP in Albania (figure 3.1). These numbers are much lower than the percentages observed in the early 1990s in Albania, but much higher in comparison to Albania's neighbors.

The figures for employment and agriculture as a share of overall GDP exceed those of advanced economies (figure 3.1). For instance, in the EU-15 area, primary agriculture accounts for 3.7 percent of employment and 1.6 percent of GDP (World Bank 2017). These uneven patterns are associated with the pace of structural transformation in the Western Balkans,

FIGURE 3.1 Agricultural transformation in the Western Balkans is accelerating



Source: World Bank 2018. Based on the data from the World Development Indicators.
Note: GDP = gross domestic product; EU = European Union.

which differs within the countries. This uneven and incomplete pace of structural agricultural transformation poses a unique set of challenges. However, the right mix of policies, including investment in irrigation and drainage (I&D), could accelerate the transformation toward more productive and more efficient farms.

Investment in I&D can play a critical role in supporting the process of structural transformation in the Western Balkans by enabling the improvement of agricultural production efficiency. However, the diversity of agroclimatic conditions and types of producers must be considered. The structural transformation that is underway offers a unique opportunity for the I&D sector to play a critical role in modernizing and transforming the productive capacity of the agri-food system of these countries.

Two important dimensions shape the agricultural sector in the Western Balkans, along with the broader structural transformation that is underway: (1) the biophysical dimension of four different agroclimatic zones, which is exogenous to all agricultural producers in the region; and (2) the three main types of producers that are endogenous to each country.

AGROCLIMATIC ZONES AND FARM TYPOLOGIES OF THE WESTERN BALKANS

Arable agriculture in the Western Balkans consists of four distinctive agroclimatic zones:

1. The **Pannonian Plain**, in the northern and northeastern parts of the Western Balkans, covers large areas of Croatia, Serbia, and the northern parts of Bosnia and Herzegovina;
2. The **Adriatic Coast** in the southwest includes significant areas of agricultural land in Albania, Croatia, and some parts of Montenegro and Bosnia and Herzegovina;
3. **The hills** cover Central Serbia and parts of Bosnia and Herzegovina; and
4. The **isolated plains of Kosovo and North Macedonia**.

Each of these zones has distinct agroclimatic characteristics. Agriculture in these regions is dominated by small family farms; some large holdings owned and managed by individuals, enterprises, or cooperatives are also present in each country. Figure 3.2 shows the distribution of farm size by country.

In most cases, this indicates three groups:

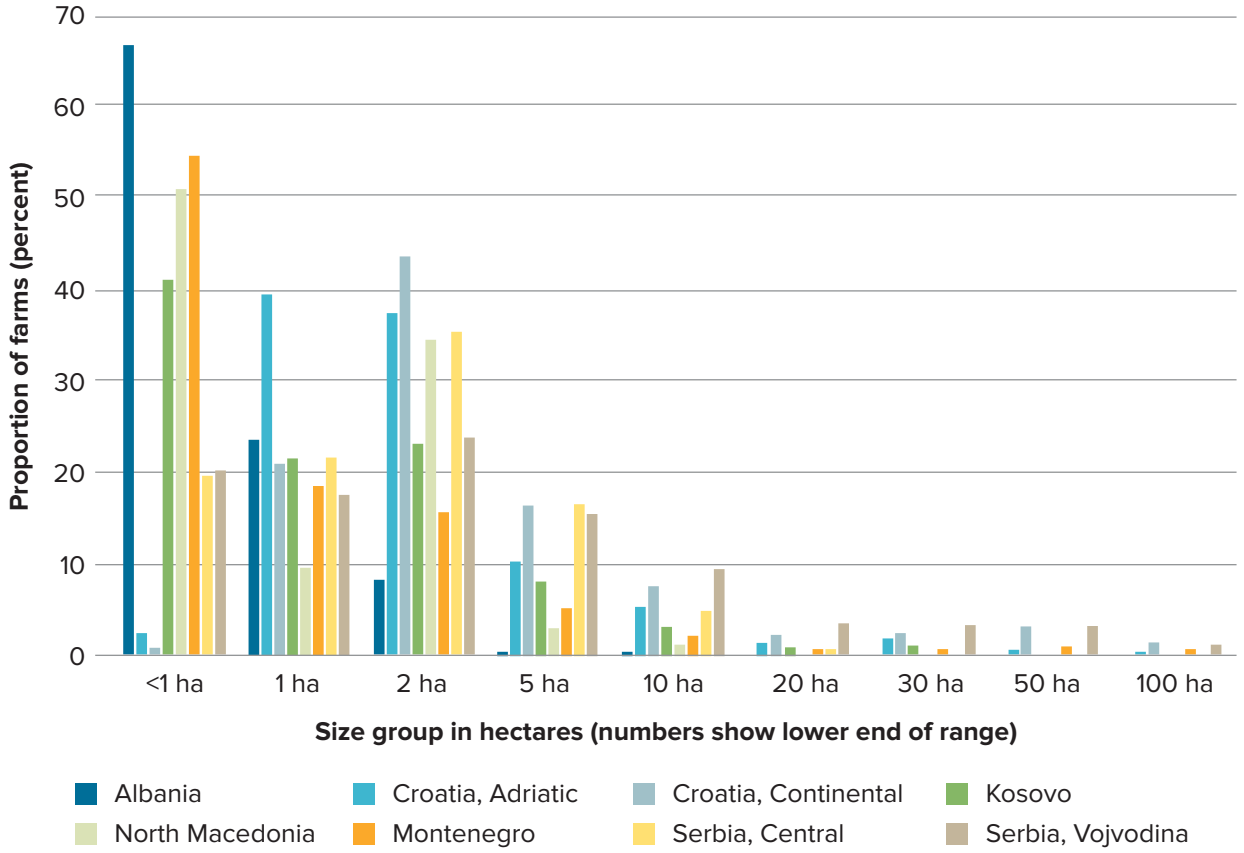
- ***Very small holdings:*** Less than 1 hectare (ha); in most of the countries this is the most numerous category.
- ***Medium-sized holdings:*** From 1 to 5 hectares, depending on the region.
- ***Large holdings:*** More than 30 hectares. As seen in this graph, this group is only visible for Continental Croatia, Adriatic Croatia, Montenegro, and Vojvodina.

Figure 3.3 shows the amount of land rather than the number of holdings, to show the proportion of the total amount of agricultural land used by each size group.

Three main trends can be seen from this graph:

- ***Very small holdings*** (less than 1 hectare) while by far in the most numerous category, are on average so small that they usually show no peak at all, with only Albania, North Macedonia, and Kosovo representing 10–20 percent of the land in this category.
- ***Medium-sized holdings*** (1–5 ha) This category contains a substantial proportion of the total land in each case, sometimes concentrated in a single category (as in Albania, North Macedonia, and Kosovo), and sometimes spread over two or even three adjacent categories (as in Adriatic Croatia).

FIGURE 3.2 Distribution of farm size by country



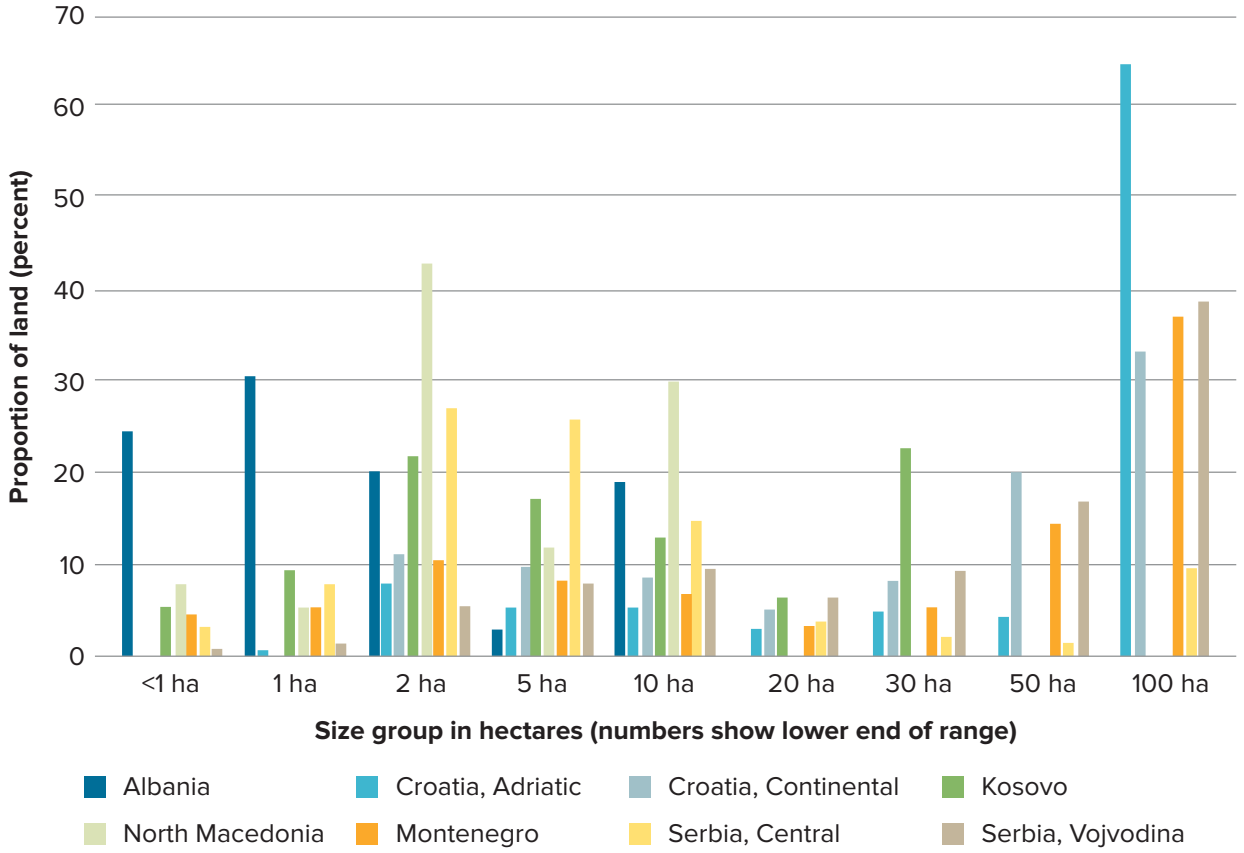
Source: Most recent agricultural census from each country.

- The ***large holdings*** category (6–30+ ha) is now clearly visible in all regions, and usually accounts for 20–40 percent of all land. The outliers are Central Serbia, where only 10 percent of the land falls into the largest size group; Adriatic Croatia, where over 65 percent of the land lies on holdings of more than 100 hectares; and Montenegro and Vojvodina, where nearly 40 percent of all land is in holdings of more than 100 hectares.

This diversity of farm types leads to a typology of farming systems that demonstrates that the region is dominated by small, often fragmented farms, with most farm households deriving their income from off-farm activities. Using the data provided above, the following useful typology of farms can be formulated:

- ***Small household farms:*** Typically producing entirely for consumption by the household and extended family.
- ***Mixed-income commercial farms:*** Typically, medium-sized, producing partly or mainly for sale, but gaining most of the household income from non-agricultural jobs or pensions.

FIGURE 3.3 Proportion of land by farm plot size



Source: Most recent agricultural census in each case.
Note: Here the statistical limitations become more apparent: the largest size category for both Albania and North Macedonia is "10 ha +"; so, it includes farms with as few as 10 hectares as well as those with hundreds or thousands of hectares.

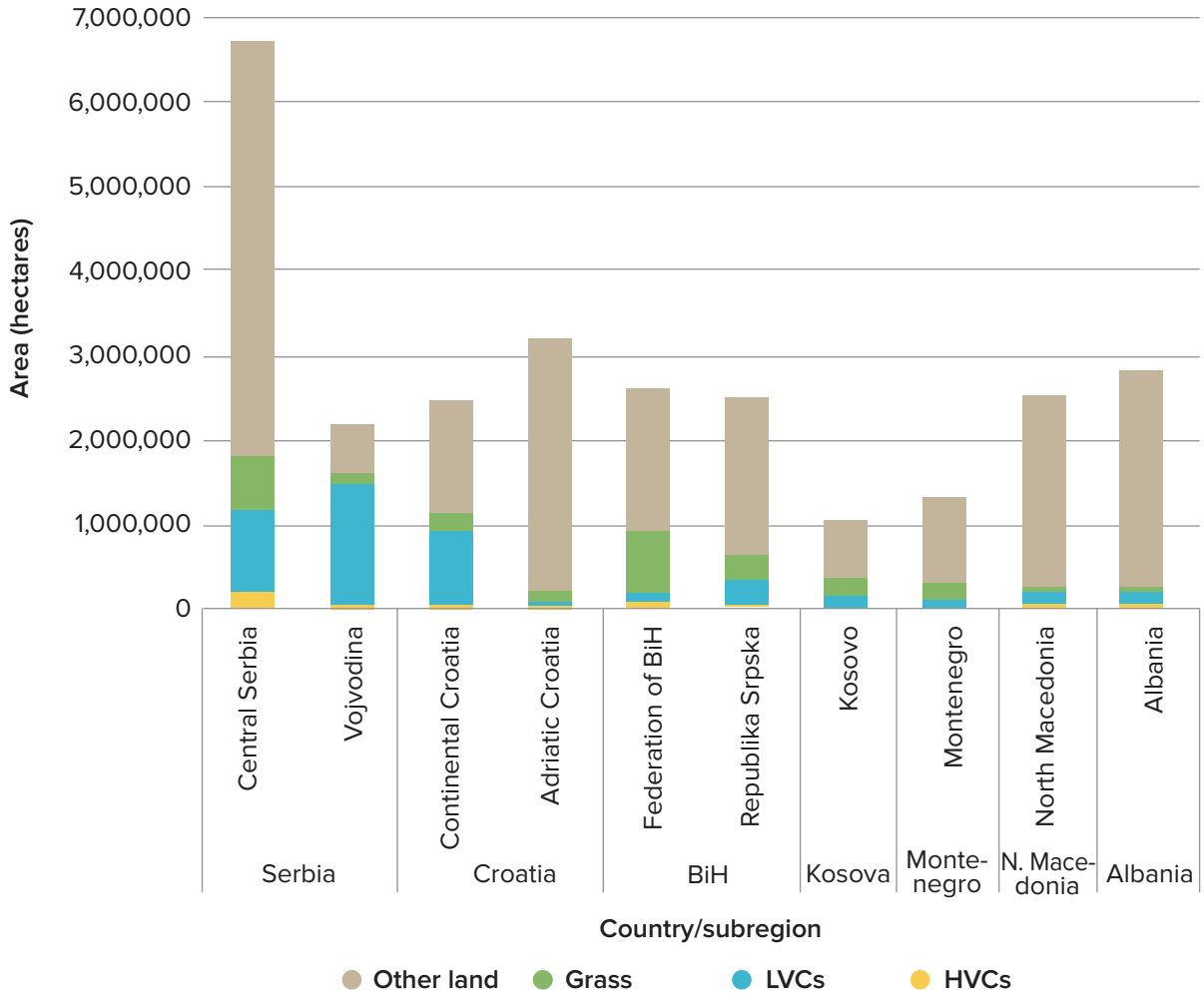
- ***Full-time commercial farms:*** Typically, large, producing almost entirely for commercial sale, and often providing most of the household income.

Mixed-income commercial farms account for most of the farm holdings, most of the land, and most of the irrigated output in the Western Balkans; this has implications for how the irrigation and agricultural sector reforms should be targeted and designed.[1] The reality of the diversity of farm types across the Western Balkans is illustrated in figures 3.2 and 3.3. This diversity has important implications for public sector interventions in the I&D as well as agricultural sectors. The objectives and constraints of small household farms, compared to mixed-income commercial farms, are significantly different than those of large, full-time, commercial farms. These affect farm-level decisions at every level, including decisions about irrigation and water management. For example, mixed-income commercial households may need to decide how to allocate their

limited time, energy, and capital between agricultural production and other activities; hence, they may not respond to the availability of irrigation in the same way that full-time commercial farms do. This has implications for the way irrigation and agricultural interventions are targeted to this group. However, these are also the type of farms that are most likely to grow high-value crops, which are water intensive. Hence, the type of irrigation technology used may be a critical element in investment decisions for these farm types.

In terms of overall land use for agriculture, 35 percent is pastureland and 65 percent is cultivated; of the cultivated land, 87 percent of the land is used to grow low-value arable crops and grass, and 13 percent is used to grow high-value crops (figure 3.4).

FIGURE 3.4 Land use by country and by subregion



Source: National Statistics, supplemented by the BiH Strategic Rural Development Plan.
Note: BiH = Bosnia and Herzegovina; LVC = low-value crop; HVC = high-value crop.

The only subregion where most of the land is used for agriculture is Vojvodina (in Serbia), on the Pannonian Plain, where almost three-quarters of the land is farmed; followed by the contiguous region of continental Croatia, where 47 percent of the land is under crops and pastures (table 3.2). Extensive areas of bare or sparsely wooded mountains in the remaining regions provide a large catchment area for rain and snow, contributing to the high level of internally renewable water resources in the Western Balkans.

Three subregions—***Central Serbia, Vojvodina, and Continental Croatia***—account for more than 70 percent of the total cropland in the Western Balkans (table 3.2).

The distribution of high-value crops is different, since the subregions with smaller areas of cropland tend to use more of it for high-value crops (see table 3.3).

- 57 percent of total crop area in Adriatic Croatia;
- 43 percent in the Federation of Bosnia and Herzegovina;
- Around 20 percent in Albania, North Macedonia, Republika Srpska, and Central Serbia.
- High-value crops play a smaller role in Kosovo, at 14 percent of the total crop area, and around 5 percent in Continental Croatia, Montenegro, and Vojvodina, where most cultivated land is used for low-value arable crops and grass.

TABLE 3.2 Areas of high-value crops, low-value crops, grass, and other land use, by country
(in hectares)

Country/subregion	HVCs	LVCs	Grass	Other land use	Total area
Serbia	**269,000**	**2,412,000**	**756,000**	**5,413,000**	**8,850,000**
Central Serbia	222,000	965,000	641,000	4,860,000	6,689,000
Vojvodina	47,000	1,447,000	115,000	553,000	2,161,000
Croatia	**106,000**	**901,000**	**379,000**	**4,268,000**	**5,654,000**
Continental Croatia	61,000	867,000	227,000	1,313,000	2,469,000
Adriatic Croatia	45,000	34,000	151,000	2,955,000	3,185,000
BiH	**167,000**	**409,000**	**1,018,000**	**3,521,000**	**5,114,000**
Federation of BiH	89,000	119,000	728,000	1,676,000	2,611,000
Republika Srpska	78,000	290,000	290,000	1,845,000	2,503,000
Kosovo	**26,000**	**156,000**	**231,000**	**675,000**	**1,089,000**
Montenegro	**6,000**	**117,000**	**211,000**	**1,012,000**	**1,345,000**
North Macedonia	**50,000**	**168,000**	**47,000**	**2,258,000**	**2,522,000**
Albania	**51,000**	**171,000**	**42,000**	**2,545,000**	**2,809,000**
Western Balkans, total	**675,000**	**4,334,000**	**2,683,000**	**19,691,000**	**27,383,000**

Source: National statistics in all cases, supplemented by the BiH Strategic Rural Development Plan.
Note: BiH = Bosnia and Herzegovina; HVC = high-value crop; LVC = low-value crop.

Sources of water and multiuser irrigation systems, areas of intervention on which governments and donors tend to focus, represent only around a third of irrigated farms in each of these countries. The share is probably higher in Albania and North Macedonia, which have big public systems, but across the region, individual irrigation is almost certainly the dominant practice. Across the six subregions of the Western Balkans, more than half (54 percent) of all irrigated farms use individual irrigation sources on the holding, with 90 percent of these using groundwater from private wells and boreholes; 32 percent using surface water from off the holding, some through individual irrigation and some through multiuser irrigation systems; 9 percent using the municipal water supply network; and 5 percent using some other source. A prominent feature throughout the Western Balkan region is individual irrigation, in which a single farm abstracts water for its own use and takes full responsibility for the management, operation, and maintenance (MOM) of the irrigation system. Table 3.3 presents the data on sources of irrigation water by country, and the number of farms for the known sources of water in each row.

Census or survey data provided the primary sources of irrigation water for four of the territories covered by this study: Croatia, Kosovo, Montenegro, and Serbia. Of 158,000 irrigated farms, 49 percent use "groundwater on the holding," and 6 percent use "surface water on the holding." Most of the remainder use "surface water off the holding."

TABLE 3.3 Sources of irrigation water by country

Country	Water on the holding				Water off the holding		Drinking water		Other	
Region	Groundwater		Surface water		Surface water		Network		Sources	
Croatia	**5,490**	**36.6%**	**360**	**2.4%**	**5,690**	**37.9%**	**3,480**	**23.2%**	**170**	-
Adriatic Croatia	3,480	28.5%	190	1.6%	5,390	44.2%	3,140	25.7%	130	-
Continental Croatia	2,010	71.3%	170	6.0%	300	10.6%	340	12.1%	40	-
Kosovo	**22,421**	**48.2%**	**1,009**	**2.2%**	**16,346**	**35.2%**	**6,727**	**14.5%**	**3,363**	-
Montenegro	**4,429**	**36.5%**	**1,027**	**8.5%**	**4,179**	**34.4%**	**2,496**	**20.6%**	**1,248**	-
Serbia	**100,631**	**53.8%**	**13,072**	**7.0%**	**60,585**	**32.4%**	**12,696**	**6.8%**	**8,298**	-
Central Serbia	87,227	55.0%	11,505	7.3%	48,562	30.6%	11,174	7.1%	6,936	-
Vojvodina	13,404	47.0%	1,567	5.5%	12,023	42.2%	1,522	5.3%	1,362	-
Total	**132,971**	**51.0%**	**15,468**	**5.9%**	**86,800**	**33.3%**	**25,399**	**9.7%**	**13,079**	-

Source: Goss et al. (forthcoming).
Note: "Water on the holding" implies individual irrigation, where the farm directly abstracts water for its own use. "Water off the holding" implies both surface water from multiuser systems and cases where the water supply to a single farm is brought from off the holding. In Kosovo and Vojvodina, this category often refers to water from large canal networks, while in other cases it is more likely to be a former agro-kombinat, which has its own irrigation system bringing water from outside the farm.

(Details about the different types of irrigation systems and their unique constraints are described in chapter 4). In some areas, such as Kosovo, this often means a multiuser irrigation system, but in others, like Central Serbia, it usually consists of an individual farm bringing water from off the holding, sometimes using a pipe route established in the past by a cooperative, or *agro-kombinat*. The exact amount of individual irrigation practiced is therefore not known; but it clearly applies to well over half of irrigated land holdings in the region. In Serbia, for which more detailed data was available, the main multiuser systems are found in Vojvodina and are linked to the Danube-Tisa-Danube canal. In the rest of the country, most of the irrigated area uses some form of individual irrigation. There is also a tendency for the farms that use individual irrigation to be smaller, more concentrated on high-value crops, and more likely to use drip irrigation. Table 3.4 summarizes the information presented above by illustrating the four main agroclimatic zones, their corresponding countries, and which farm types and irrigation types are dominant in those countries, illustrating the diversity of the climatic zones, farm systems, and irrigation types in the region.

To maximize the size, type, and degree of I&D investment needed to enable farms to realize a higher degree of production, it is critical to understand the constraints and incentives of the various kinds of farm systems. A healthy and competitive agricultural sector in an open European Union (EU) market requires cost-effective farm operations of appropriate economic scale and technology, with efficient links to markets. Revitalization of the farm systems therefore needs to consider not only the viability of farms and the production systems themselves, but also the available market opportunities and the competitiveness and effectiveness of relevant value chains. This requires removing unnecessary physical, financial, and bureaucratic constraints, not only at the farm level but also in the upstream and downstream value chains. In this regard, investments in the improvement of I&D services are critical, but as shown in the diversity of irrigation and farm types illustrated in table 3.4, government decisions on how to invest in various irrigation schemes must begin with a detailed analysis of which farms are using surface irrigation from large-scale public canal systems as opposed to those that are relying mostly on private irrigation from private surface or groundwater sources (tube wells or borewells). It is also important to understand what crops these farms are growing, what yields they are achieving, their profit profile, and what unique constraints they face in accessing agricultural markets, insurance, and crop finance. Although every farm is different, many of the farms across the Western Balkans can be categorized into a few simple types:

1. Small part-time farms currently growing only low-value crops.
2. Small part-time farms already growing some high-value crops.
3. Larger full-time farms currently growing only low-value crops.
4. Larger full-time farms currently already growing some high-value crops.

TABLE 3.4 Dominant farm and irrigation types by agroclimatic zones in the Western Balkans

Agroclimatic zone	Relevant Balkan countries	Dominant farm typology	Dominant irrigation typology
Pannonian Plain	Continental Croatia, Vojvodina, Northern BiH	**Continental Croatia:** Mixed-income and full-time commercial farms **Vojvodina:** Full-time commercial farms	**Continental Croatia**: 71 percent private irrigation from groundwater + drip irrigation adoption; 11 percent surface irrigation from canals, 6 percent surface irrigation from private source **Vojvodina:** 47 percent private irrigation from groundwater sources and sprinkler/drip irrigation adoption; 42 percent surface irrigation from large-scale canal systems
Adriatic Coast	Adriatic Croatia, Albania, parts of Montenegro & BiH	**Albania:** Small household farms **Adriatic Croatia:** Full-time commercial farms **Montenegro**: Mixed-income and full-time commercial farms	**Albania:** 73 percent surface irrigation from public irrigation schemes + sprinkler adoption **Adriatic Croatia**: 44 percent surface irrigation from large-scale canal systems and drip irrigation adoption; 29 percent private irrigation from groundwater sources **Montenegro**: 37 percent private irrigation from groundwater sources and sprinkler irrigation adoption; 34 percent surface water irrigation from canal irrigation systems
Hills	Central Serbia, parts of BiH	**Central Serbia:** Mixed-income commercial farms and small household farms	**Central Serbia:** 55 percent private irrigation from groundwater sources and drip irrigation adoption; 31 percent surface water irrigation from canal systems
Isolated plains	Kosovo, North Macedonia	**Kosovo**: Mixed-income commercial farms and full-time commercial farms **North Macedonia:** Small household farms and mixed-income commercial farms	**Kosovo:** 48 percent private irrigation from groundwater and 35 percent surface irrigation from large-scale canal systems

Source: Authors.
Note: BiH = Bosnia and Herzegovina. The labels used to describe farm types are indicative, and not representative of the full diversity of farm types in these countries; more in-depth analysis would be needed to further substantiate the size, average cropping mix, and source of irrigation type for various farm systems in the Balkan countries. For instance, it is not unusual for one holding to produce wheat, pigs, and milk, thus combining commercial, non-commercial, and semicommercial production on the same holding. Perhaps the defining feature of farm households in the Western Balkans is how many of them are mixed: mixed both in what they produce and in what they do with their produce; and mixed in their source(s) of income. In such a situation, any labels to describe farm types must be used with care.

Each of these groups will typically respond to the availability of irrigation in different ways and will face unique constraints to marketing and selling their produce, due to their diverse financial profiles. For instance, small non-commercial producers use traditional methods to irrigate their crops or they may not irrigate at all, and simply rely on rainfall. The amount of irrigation in the region is primarily influenced by the structure of the production and the types of producers, followed by the technical possibilities for easily accessing water and investment capital.

Unlike many countries in Northern Europe, where small producer associations and cooperatives have played a critical role in linking smallholder farmers to finance, inputs, and output markets, producer associations and cooperatives are weak or non-existent in the Western Balkan countries; they are often associated with previous socialist regimes and have a generally bad reputation among farmers. There are very few such cooperatives and producer organizations that seem to be functional in these countries (World Bank 2018). As such, the aggregation mechanisms that could enable small farmers to access financing, inputs, and output markets are missing (World Bank 2018). Traders and off-takers do provide aggregation services, but the balance of power is clearly tilted toward them, with smallholder farmers getting the smaller percentage of value added in their transactions with such entities. Larger farms that are more focused on mechanized arable crops rather than intensive high-value crops need less support to gain access to markets. For investments in I&D to be able to support a variety of farm types that are growing different mixes of crops from diverse sources of irrigation and irrigation technology, a customized approach is needed that addresses their unique constraints; this can improve uptake of irrigation investments. These constraints are summarized as follows:

Constraint #10: Farmers from small household farms and mixed-income commercial farms may face high *information deficits*. This occurs where a farmer does not have reliable data on the crop and weather patterns, the effectiveness of pesticides, the nutrient composition of fertilizers, the germination rate of seeds, the health status of planting materials, or access to price data in nearby markets; this can in turn dampen demand for the uptake of irrigation services.

Constraint #11: Small household farms rarely have access to land and credit markets. These farmers also have little incentive to make investments to increase their on-farm irrigation development, since they have limited potential to market their produce and connect with off-takers and buyers, as well as to access finance. An important feature of this region is that many farm households have a mixture of income sources, so their agricultural investment and production decisions are often influenced by non-agricultural considerations, as well as by the profitability of farming. This may partially explain why the uptake of irrigation systems

by farmers is still problematic in several regions, such as in parts of Croatia and Albania; particularly in Albania, where there is a high percentage of small household farms.

The World Bank Group can play an important role in unleashing the potential of the structural transformation currently underway in the agricultural sector in the Western Balkans by providing customized I&D infrastructure solutions based on the needs of diverse farm systems, complemented with investments in agricultural modernization both on and off-farm. The old paradigm of investing in large-scale infrastructure rehabilitation with limited returns and limited applicability to many small and mixed-income farms is falling away. This implies that **much of the current approach to improving I&D systems is a legacy of past priorities and objectives, and a new set of priorities to drive transformation is needed; priorities that are grounded in the realities, incentives, and constraints of a variety of farming systems**. To improve the functioning of irrigation systems, there is a need for coupled and complementary investments that can help mixed-income, part-time farms that are growing mostly low-value crops to transition toward a sustainable, more profitable crop base while enhancing the potential of irrigated areas, particularly in Albania and Kosovo.

The ongoing transition toward the EU, coupled with climate change, and an incomplete structural transformation in the agricultural sector means that not all irrigated agriculture can be salvaged, and that consolidation will be an important part of the transition process. Thus, a more selective approach based on farm and agroclimatic dynamics is needed; one that can help farmers (1) transition from household consumption alone toward commercial, market-oriented agriculture; (2) provide safety nets for those farmers who may be forced to drop out of agriculture; (3) help design investments that meet the requirements of reduced water pollution and negative environmental impacts, in order to align with the Water Framework Directive, EU accession, and the Green Agenda policy priorities of the Western Balkans; and (4) promote investment in private (as opposed to large-scale public) irrigation for the more commercial and market-oriented agriculture farms that rely largely on private irrigation from groundwater sources. In this regard, the World Bank, with its substantial history of expertise in the water, agriculture, rural development, environment, and climate change sectors in the Western Balkans, is uniquely positioned to work across multiple sectors. ***For I&D that will enable the structural transformation in the Western Balkans to be completed, to meet the requirements of EU accession and enhance resilience against climate risks, a fundamental paradigm shift in the irrigation sector is needed.*** This will entail a shift from emphasis on the rehabilitation of existing large-scale public irrigation schemes to customization of I&D investments to meet the social, economic, and environmental needs of diverse farming and water resource systems.

NOTE

1. "Mixed income" commercial farms are defined as "mixed" since agriculture contributes just a proportion of farm household income in this category. It is also important to note that these farms are run by "part-time" farmers, as some family members spend most of their working time on the farm while others find employment elsewhere.

4

Dominant Irrigation and Drainage Infrastructure Trends and Constraints

WATER RESOURCES

All of the countries of this region are, on average, well-endowed with water resources, and the total water use is relatively low, with abstraction levels at less than 10 percent of internal renewable water resources, and less than 5 percent of total renewable water resources. Water use for agriculture accounts for less than half of total withdrawals in every part of the region but varies considerably from country to country. Agricultural water use accounts for the highest shares in Kosovo (43 percent) and Albania (39 percent); a moderate share in North Macedonia (24 percent) and Serbia (13 percent); and just 1 percent of total withdrawals in Croatia and Montenegro.

There is great spatial and temporal variation within these countries, and in addition to the type and scheduling of crops, the need for irrigation depends on current and expected changes in climate and rainfall patterns across the region. Currently, rainfall deficits are rising progressively from the northwest to the southeast. Croatia has a maximum deficit of 50 mm in July, and an average deficit period of around 7 months, while Albania has a maximum deficit of 150 mm in August and a deficit period from April to September. In the northwestern part of the region, the relatively small rainfall deficit means that a deep-rooted crop can be produced by using residual soil moisture without irrigation; however, where there are significant deficits (for example, in Albania) cropping is not possible in the summer, and winter temperatures are too low for cropping, thus reducing the growing season to only early spring. This underscores the importance of having adequate irrigation and drainage (I&D) structures, so that farmers can grow their crops beyond the early spring. Moving further southeast and inland, significant deficits develop earlier in the year and are starting to limit the ability of farmers to grow winter cereals and grass. The extent of the deficit varies from

year to year, with a significant yield reduction occurring about 1 year out of every five in the southeastern parts of the region.

Important groundwater resources can be found in the Pannonian Plain and in the valley bottoms of major tributaries. Groundwater resources in the coastal areas are subject to salinization when they are overexploited. At present, exploitation of groundwater for irrigation is not encouraged, and in most countries, permits are required by law, if not in practice. Detailed information on sustainable aquifer yields is not yet available; further investigation into this matter is recommended.

STATUS OF IRRIGATION

Neither Yugoslavia nor socialist Albania had a national network of state-run irrigation canals like those found in Armenia, Ukraine, and other former Soviet republics. There was more variation around the region, and a greater emphasis on locally run systems to meet the needs of individual *agro-kombinats*. Given the combination of water resources, farm structures, and the institutional history of the Balkan countries, the dominant system throughout the region is individual irrigation from private boreholes and surface water on the holding, very often done without an official license or permit. This has resulted in financially sustainable, targeted irrigation being delivered direct to the holdings that want it, without the complications and overhead costs of supplying water to multiple users. However, it has also left many areas without irrigation, and left water resource managers with little idea of how much water is being abstracted, and by whom. In other areas, some of the former *kombinat* systems have been successfully transformed into irrigation systems for private farms, with the transformation being smoothest where farms are large.

The newest form of irrigation development consists of multiuser systems developed by local municipalities using whatever water source is available to them, including rivers, reservoirs, aquifers, and mountain streams. Development over the last 30 years has further increased the variety of sources, and the systems now found across the region include:

- Large-scale canal systems
  - Dedicated irrigation canals
  - Dual-purpose I&D canals
- Local multiuser systems
  - From reservoirs
  - From rivers
  - From boreholes

- Individual irrigation
  - From boreholes
  - From rivers
  - From dual-purpose water networks
  - From municipal water supply networks

Overall, irrigation in the region falls into two main institutional forms:

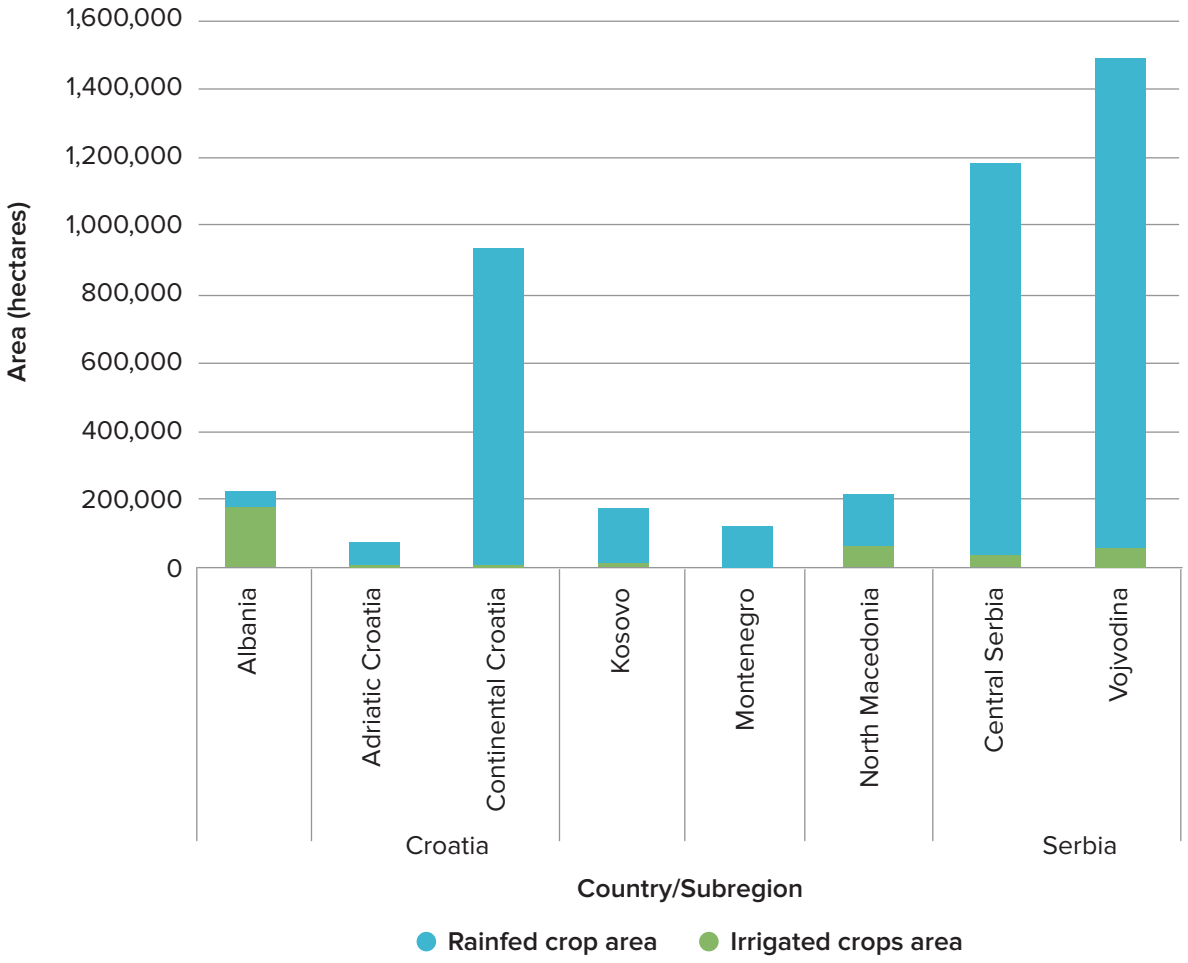
- ***Individual irrigation***, where a farm abstracts water from a well, borehole, public or private tap water supply, or nearby river for its own, and its sole, use.
- ***Multiuser irrigation***, where organizations abstract ground or surface water, and distribute it to multiple farms. This can be subdivided into:
  - *Local irrigation*, where a municipality or water users' organization abstracts the water and delivers it to users.
  - *Large-scale irrigation*, where a regional or national organization conveys water significant distances by canal or pipeline, then hands it over to local organizations for distribution to farmers.

The data indicates that across the Western Balkans, just over 60 percent of irrigating farmers use groundwater, and almost 40 percent use surface water; however, this is counted in holdings, not hectares. One conclusion that emerges from this data is that multiuser irrigation systems, upon which governments and donors tend to focus, represent only around a third of irrigated farms in these countries.

The largest area of irrigated land is found in Albania, where the total area is equal to 79 percent of the land under crops (176,000 hectares).[1] This represents 47 percent of the region's irrigated land. The country with the second largest area is Serbia (98,000 ha of crops, plus 800 ha of irrigated grass) (figure 4.1). Serbia has 27 percent of the total area of irrigated land in the Western Balkans, though less than 4 percent of its crop area is irrigated. North Macedonia takes third place (65,000 ha) in this ranking, with 17 percent of the region's cropland under irrigation,[2] making North Macedonia more dependent on irrigation than anywhere else in the Western Balkans. Thus, these three countries account for 91 percent of the region's irrigated land. Kosovo[3] and Croatia each have around 15,000 of irrigated crop area, with 8–9 percent of the total crop area irrigated in Kosovo and Adriatic Croatia, but a much smaller share in Continental Croatia (figure 4.1). Montenegro has little cropland in total, of which 2 percent, representing just 3,000 ha, is irrigated.

The values at the bottom of each column in figure 4.1 give the irrigated crop areas as absolute values, and as percentages of the total crop area. Available statistics also report significant areas of irrigated grassland in Kosovo (7,000 ha) and North Macedonia (4,000 ha);

FIGURE 4.1 Breakdown of rainfed and irrigated crop areas by country

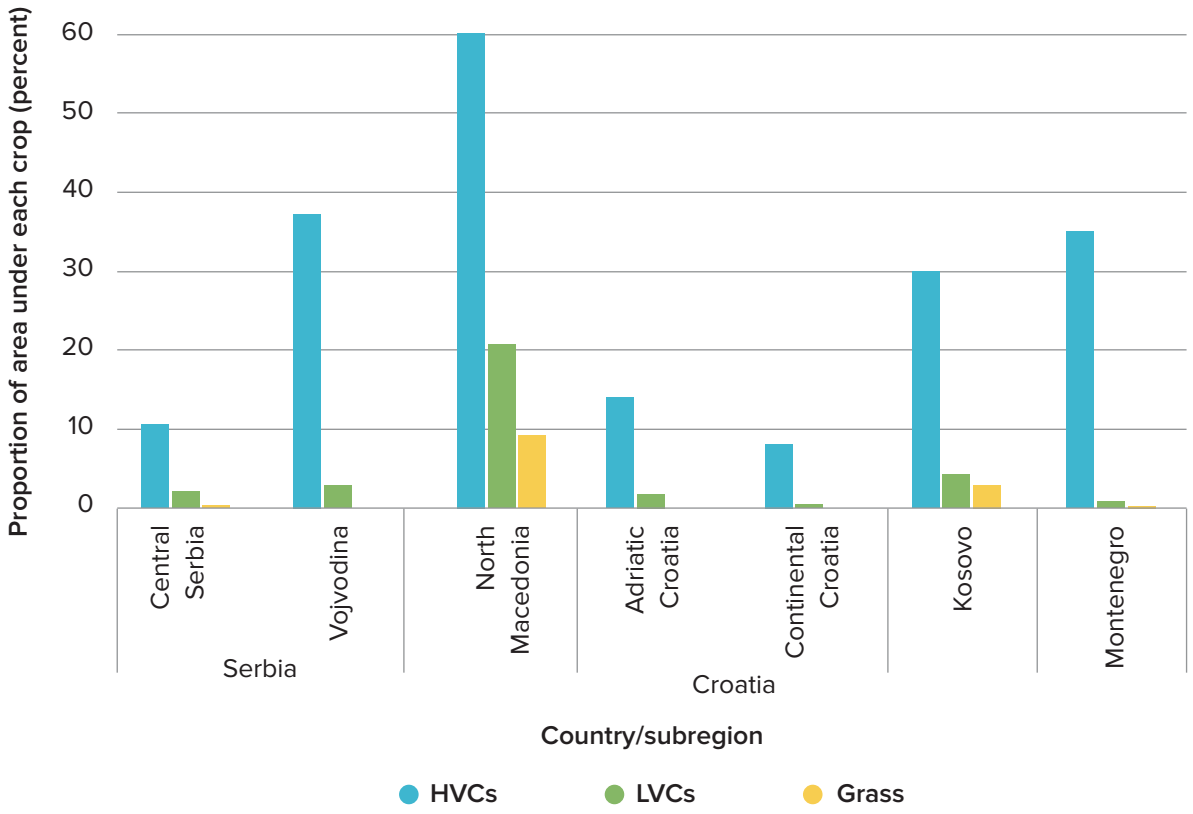


Source: Goss et al. (forthcoming).

these are not shown in this chart. For Albania, the irrigated area is not broken down by crops, so it may include some grassland; however, the chart shows that the largest share of irrigated area is in Albania with respect to the other countries.

Most countries grow high-value crops on about 10–30 percent of their irrigated area, with this figure rising above 50 percent in North Macedonia, while Serbia, North Macedonia, and Kosovo are also growing low-value crops or grass in irrigated areas.[4] In Albania, the primary crops under irrigation include vegetables, grass, and maize. Kosovo has an almost equal mix of irrigated high-value crops, low-value crops, and grass. Figure 4.2 shows the percentage of each crop type that is irrigated. The chart illustrates that across the whole Western Balkans region, only 14 percent of the high-value crops are irrigated, due in part to large areas of unirrigated fruit, vegetables, and potatoes grown in Central Serbia. For low-value crops, irrigation plays a smaller role. The share of irrigated low-value crops is greater than 5 percent only in North Macedonia, and averages 2.4 percent for the Western Balkans

FIGURE 4.2 Percentage of irrigated crops by type



Source: Goss et al. (forthcoming).
Note: Data on Albania is not available. LVC = low-value crop; HVC = high-value crop.

overall (figure 4.2). Irrigation of grass is only practiced in North Macedonia and Kosovo, and overall, just 0.5 percent of grassland is irrigated. Although data for Albania is not represented in figure 4.2, crop production represents nearly 50 percent of the sown area in Albania, which is dominated by field crops (cereals, vegetables, legumes, industrial crops, and forage), as well as permanent crops such as fruit trees and grapevines.

Most of the area under crops, even that of high-value crops, is directly dependent on rainfall in the Western Balkans; as such, it remains highly sensitive to the temperature and precipitation changes anticipated by climate change. This illustrates the transitional and diverse nature of the agricultural sector across the Western Balkans, where some of the countries are transitioning to greater areas growing high-value crops, with others constrained by poor markets, weak institutions, and underdeveloped I&D services, leading to a larger share of the irrigated area growing low-value crops. **This underscores the importance and relevance of increasing the area of irrigated crops, and simultaneously addressing the bottlenecks that small household farms and mixed-income commercial farmers encounter in trying to grow and market higher-value crops**, as was discussed in chapter 3.

Most governments of the region have inherited a legacy of malfunctioning or completely nonfunctional infrastructure from the large I&D systems that were constructed during the socialist era. These are some of the main causes for the deterioration of these systems:

- The political process associated with the change to the current democratic system caused a large abandonment of agricultural activities in several countries for relatively long periods of time. Furthermore, the land redistribution process that followed often resulted in farm structures that were not compatible with the existing irrigation systems.
- Many I&D systems were seriously affected by various conflicts in the region.
- Several of the I&D systems that were constructed in the socialist era proved to be economically unviable and were abandoned.
- Many of the systems suffered from shortages of funds due to poor recovery of fees, which often resulted in maintenance being delayed to the point of making the systems unusable.
- Adapting the old system of managing the irrigation systems to the new conditions has proved challenging, and results were often not up to the expectations.
- Several different irrigation management structures have emerged across the Western Balkans to carry out the role of irrigation operation, management, and maintenance, each with its strengths and weaknesses, and reflecting the legal structures and established practices of the country.

IRRIGATION MANAGEMENT STRUCTURES

The main institutions responsible for the management of multiuser irrigation systems in the Western Balkans are described below.

PUBLIC ORGANIZATIONS

Municipalities and their I&D units

Municipalities act as the central point for identifying local water user needs; financing preparatory studies for investment (feasibility studies, project designs, etc.); supervising and financing the construction of infrastructure; and managing irrigation facilities.
In general, the municipalities are owners of the irrigation infrastructure that is within their boundaries; therefore, they are responsible for its management either directly or indirectly.

Sometimes the management is undertaken directly by the municipalities' Irrigation and Drainage Units (IDUs), as in the case of Albania; in other cases, it is managed through water utility companies (WUCs), which are mostly public, but in a few cases are private companies, as described in the next paragraph. This system is used to a greater or lesser degree in nearly all the countries of the region.

Public and private utility companies

These are companies that operate with a high degree of autonomy in providing services for the operation and maintenance (O&M) of I&D systems. They operate at the central, regional, and local levels (box 4.1). For example, the national public company "Iber—Lepenc" in Kosovo manages the infrastructure in seven municipalities (Zubin Potok, Mitrovica, Vucitrn, Obilic, Pristina, Kosovo Polje, and Glogovac). This multifunctional

BOX 4.1 **Public water service providers in Kosovo**

- **Central Publicly Owned Enterprises**
  - Public enterprise HPE Iber Lepenc JSC;
- **Regional Irrigation Companies**
  - Irrigation Company Drini i Bardhe J.S.C.;
  - Irrigation Company Radoniqi-Dukagjini J.S.C.
- **Regional Water Companies**
  - Regional Water Company Prishtina J.S.C, Pristina
  - Regional Water Company Hidrodrini J.S.C, Peja
  - Regional Water Company Hidroregjioni Jugor J.S.C, Prizren
  - Regional Water Company Mitrovica J.S.C, Mitrovica
  - Regional Water Company Hidromorava J.S.C, Gjilan
  - Regional Water Company Radoniqi J.S.C, Gjakove
- **Local Publicly Owned Enterprises**
  - Water and Waste Company Ibar, Zubin Potok
  - Water Waste Company 24 November, Leposavic
  - Regional Water Company Bifurkacioni J.S.C, Ferizaj/Kacanik

Source: KEPA 2015.

enterprise supplies water to several regional water supply systems in Kosovo and provides water for irrigation, hydropower, and industry, including to large industrial companies such as Trepca, Kosovo B, A, and Kosovo Feronikl. In Serbia, the day-to-day O&M in the Vojvodina region is implemented by 16 state-owned and two private water management enterprises, while in Central Serbia there are 14 water management enterprises and plans for some of the new local irrigation systems to be managed by public enterprises that provide a range of municipal services, such as waste collection and street maintenance, rather than by water companies. This system is also found in Bosnia and Herzegovina.

Irrigation and Drainage Directorates were recently established in Albania in the regions of Lezha, Korca, Fier, and Durres for the management of 22 intermunicipal irrigation canals, 7 big reservoirs, and 27 drainage pumping stations, together with the main drainage channels and flood protection works. These canals cross municipality boundaries: the directorates are responsible for their management, but lower-level canals are operated and maintained by the municipalities in which they are located. The directorates are also responsible for the maintenance of the drainage systems. In Croatia, the river basin directorates of Vode Hrvatske have a similar role in large systems.

FARMERS' ORGANIZATIONS

Water Users Associations (WUAs), and Water User Organizations (WUOs) are farmer-owned, and farmer-managed organizations created to manage and maintain irrigation or drainage systems. Since early 2000, significant efforts have been made to promote their establishment in the region, but the results have been modest. Significant efforts were made to establish WUAs in Albania, but at the end of 2016 the government decided to transfer their functions to the IDUs of the municipalities, although the law still recognizes their existence, and it is still possible to establish them. A few small WUAs are currently operational in Bosnia and Herzegovina and in Serbia, but they lack the necessary legal support.

In North Macedonia, associations of water users were established under the former Yugoslav Republic of Macedonia, with responsibility for making the main decisions concerning irrigation**,** as well as participation in broader water resource management and development. However, in the late 1980s these associations were found to be ineffective, and were abolished in 1991, leaving the end users little representation in local water management councils, and in water affairs generally. In 2004 with the new law, irrigation water communities (IWCs) were established, and federated in the Union of Irrigation

Water Communities. They are generally responsible for water distribution in tertiary canals. However, the irrigation program of the Southern Vardar Valley is considering transferring the responsibilities for future O&M of the irrigation schemes to the IWC from former organizations known as "water economies."

Cooperatives

The main difference between a WUA and a cooperative is that the cooperative is an association made of voluntary members, and nobody can force a farmer to be member of it. On the contrary, a WUA is established by most of the farmers within the perimeter of the irrigation system (normally 60 percent is required); but once it is established, all farmers within the equipped area must be members of the association, even if they were not initially in the agreement.[5] Cooperatives are found in all of the Western Balkan countries, but few of them are concerned with irrigation management. Normally agricultural cooperatives are not concerned with the management of irrigation systems, but if the members agree to do so, they can handle irrigation management, either directly or by contracting a company to do the work or hiring the needed staff. In Bosnia and Herzegovina some agricultural cooperatives have taken responsibility for the management of the irrigation systems, with remarkable success (see chapter 5 for a detailed illustrative case study).

Private commercial companies

Large agricultural areas are generally managed with this type of enterprise, which is normally formed in places where in the past *agro-kombinats* were functioning. There are several models: limited liability companies (LLCs); anonymous societies; and shareholders companies. The most common structure is the LLC, because it establishes a financial limit in case of bankruptcy; but normally an LLC cannot have more than 50 members (the number depends upon the legislation of each country). Private commercial companies are very business oriented, and they rent agricultural land from the government. Normally they have a board of directors and a president, and they select a technical director who manages the society, assisted by technical staff and workers. The Novo-Selo company in the Republika Srpska (RS) is a typical example; it has more than 100 employees. Like most shareholder companies, their establishment is based on the financial contributions made by the members (normally farmers, but not necessarily) to form the initial capital of the company through their contributions. The benefits are shared in proportion to the amount of the contributions made. From a legal point of view these companies are a single entity, notwithstanding the fact that they are made up of by a variable number of members, and therefore in many aspects they are considered as a single farm entity. As there were *agro-kombinats* in all the countries of

the region, this type of organization is very common, and is widely used in North Macedonia, Serbia, and other countries.

COMBINED PUBLIC AND FARMERS' ORGANIZATIONS

Public utility companies and farmers' associations

This is a situation where the public company does most of the technical work, but some very limited functions, such as information exchange, monitoring use of the system, and some limited maintenance work, may be entrusted to the WUA or to a cooperative (though this is very rarely done). This appears to be a satisfactory interim arrangement until the WUAs evolve and can take on more responsibilities, though few examples are available. They are widely used in North Macedonia and have been tried out in Bosnia and Herzegovina with a certain degree of success.

Public-private partnerships

Public-private partnership (PPP) schemes have been under discussion since 2012, and some specific proposals were made in Albania with the support of the World Bank. However, this has had limited practical application. With a renewed interest in the development of irrigation this is a possibility that merits a fresh look.

Across the region, public management models are used much more frequently than cooperatives, WUAs, and private commercial companies. In part this reflects a tradition of public management of I&D, and in part it stems from the negative experience of enforced cooperation during the socialist era. Against this background, the efforts made by several international agencies to promote WUAs have had only limited success, and the idea of adopting legislation, including legislation to allow compulsory membership, was not politically attractive. On the other hand, most of the public companies are facing serious financial problems, since their income is considerably lower than their expenditures; for example, in the case of North Macedonia these companies were reconverted to water economy enterprises because they were in bankruptcy. Thus far, only three countries (Albania, Kosovo, and North Macedonia) have dedicated WUA legislation in place; Serbia has a draft proposal that has not yet been approved. Hence many of the currently functioning WUAs do not have a proper legal basis, and may not be established as legal entities, making their operation difficult. It is likely that the management of the irrigation systems will continue to be undertaken predominantly by public institutions. However, considering that most of these entities have serious problems of financial sustainability, there may be advantages for hybrid models, where farmers' organizations work jointly with public bodies.

With respect to the financial sustainability of irrigation systems, numerous irrigation fee systems and tariff structures can be found throughout the region, covering different proportions of the operation, maintenance, and capital costs. In most of the smaller systems, fees are set by the management system (WUAs, municipalities, or management companies), often within a framework of government rules, as is done in Albania, Croatia, and Serbia. In Croatia and Bosnia and Herzegovina, districts or municipalities contract out the management to private or public companies through competitive bidding. However, in many cases the winning bids have been too expensive for the municipalities; consequently, in Croatia the management was returned to the government agencies. In any case, the fees are, in many instances, below the actual O&M costs, and the rates of collection by the managing institutions are also low; this often leads to unsustainable financial situations that are eventually resolved by governments financing the deficits, which often are in the magnitude of millions of dollars. Hence, **setting adequate irrigation fee policies and more effective cost recovery mechanisms may contribute substantially to improving the financial sustainability of irrigation service delivery institutions.**

DRAINAGE MANAGEMENT STRUCTURES

At the regional level, more than 60 percent of the arable land is covered by drainage systems; this overall level of coverage appears satisfactory, but since almost all of these systems are suffering from insufficient maintenance, their efficiency is highly questionable. The use of drainage to make agricultural operations possible, and to increase the productivity of land in the northern part of the Western Balkan region began much earlier than irrigation; it dates to the mid-1800s and covers very large areas. At present some 3.6 million hectares are covered by drainage systems; this represents 62 percent of total arable land in the region, rising to more than 80 percent in Serbia and Croatia. This provides reasonably satisfactory coverage of the areas that are seriously affected with problems of waterlogging.

Croatia and Serbia together account for more than 80 percent of the region's crop land (arable land and orchards). They have constructed drainage systems that cover more than 90 percent of the arable land; therefore, they have a drainage infrastructure with the capacity to meet most of the needs of the agricultural sector. The area covered by subsurface drainage in Croatia and Serbia is close to 200,000 hectares, indicating the importance that farmers attach to solving the problems of serious waterlogging. Unfortunately, the maintenance of the systems is well below what is needed; this has a negative influence on agricultural production in these areas.

Albania also has a significant part of its arable land covered by drainage systems (45 percent); most of these are associated with irrigation systems. However, a considerable number of the systems are non-operational: more than 100 pumping stations are not functioning or suffer from extremely low efficiencies. Overall maintenance is well below the level needed, and rehabilitation of the system has been recurrent, and often financed from external sources. Bosnia and Herzegovina and North Macedonia have less than 20 percent of their arable land covered by drainage systems, but because of the undulated nature of the arable lands in many places the actual covered area may not be far from the actual needs. As in other West Balkan countries, proper maintenance is a recurrent problem.

For both Kosovo and Montenegro, information about the coverage of drainage systems is not available; hence, a diagnosis of the situation in these countries is not possible. Montenegro is a country with only a small amount of arable area, of which only 2 percent is covered by irrigation systems (including individual systems). Since irrigation systems typically also include drainage systems, it has been assumed that the area covered by drainage infrastructure in Kosovo is on the order of 4,500 hectares. In absolute terms, the area still in need of irrigation will be small.

Drainage systems are normally managed by the same institutions that are responsible for the management of public irrigation systems. An exception to this is in Albania, where drainage systems that cross municipality boundaries are managed by the new drainage boards that were established in 2016. In all cases, maintenance of the drainage systems is a government responsibility, but since farmers profit considerably from the drainage systems, several of the governments require farmers to contribute to their operation and maintenance through a drainage fee.

All countries of the region suffer to varying degrees from poor maintenance of the drainage systems, with serious negative repercussions for agricultural production. The greater the inefficiency of the drainage system, the larger the negative effect on agricultural production. A considerable number of the region's drainage systems are not operational; for instance, in Albania about 100 pumping stations are no longer functional due to breakages, and others because their operational costs have become unaffordable. There is a widespread need for rehabilitation of the existing drainage systems. Theoretically, the drainage fees should be sufficient to cover the cost of a proper system of maintenance, but there seem to be no cases in which this is occurring in practice. For example, in the province of Vojvodina in Serbia, which has half of the entire region's drainage area, the drainage fees of €10–15/hectare are almost universally paid, but they cover only half the maintenance costs. In the other countries, both drainage fees and collection rates are much lower, increasing the burden on already-stretched government budgets. **Important policy issues for the whole region include determining why**

governments feel that they are unable to set drainage fees at the levels needed to cover costs, and why they so often struggle to collect the fees that are set.

Since governments are often short of financial resources, they tend to reduce expenditures by delaying maintenance tasks and extending the routine maintenance cycle from the planned 3 years up to 6 years or even more. The problem is that if an earth drainage canal is left without maintenance for 5 or 6 years, vegetation growth, sedimentation, and erosion of the banks will greatly reduce its capacity to evacuate water and may render the whole system ineffective. A pattern seen in many parts of the region, such as in Albania, is long-term neglect of preventative maintenance, followed by large-scale rehabilitation projects financed from external sources. However, this approach is more costly than carrying out regular maintenance, for two reasons. One is that crop yields are reduced over all the years of inadequate drainage, due to prolonged waterlogging that can cause high production losses. The second reason is that the work of removing large vegetation accumulated over several years is costlier than the removal of smaller vegetation and sediments at regular intervals.

The sustainability of the drainage systems is heavily dependent on the governments' ability to recover a sizeable part of the cost required for their proper operation and maintenance. It is arguable whether society should pay for the maintenance of drainage systems that benefit specific groups of farmers; therefore, this question is rarely given priority when budgets are tight. Due to financial shortages, governments tend to request foreign loans for the rehabilitation of drainage systems. In most cases this costs more than regular maintenance, and certainly decreases the benefits to farmers. However, the efficiency of these systems may be limited by how well the drainage network into which they discharge is maintained.

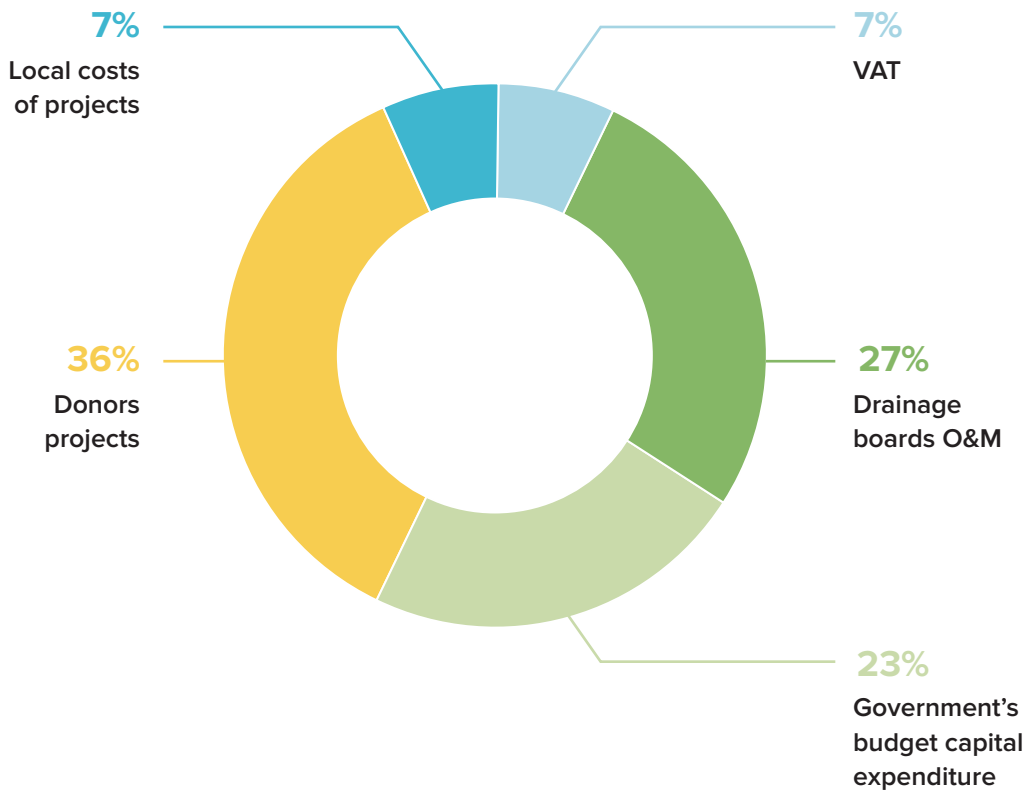
FINANCING I&D

Financing of the state I&D infrastructure is always covered by the respective governments, across all of the countries in the Western Balkans. On the other hand, individual farmers who are accessing water directly for their farms must bear the cost of the corresponding investments, although some subsidies are possible through Instrument for Pre-Accession Assistance for Rural Development or other rural development programs. No recovery of the capital cost is applied in the countries of this region, except in Republika Srpska, which requests a down payment of 30 percent of the capital costs from the beneficiaries of the project at the time of construction. This measure has proved extremely useful in terms of knowing in advance who is really interested in the project and willing to participate in its financing, thus reducing the number of potential beneficiaries who do

not use the system once it becomes operational; it also represents a significant financial contribution that may facilitate the financing of other projects.

Financing of capital costs for I&D has several different sources, including the national budget, European Union (EU) funds, local authorities, and contributions from system users. Of course, the state budget is largely derived from taxes, and one relevant rural tax is the land tax. In Croatia, the financing of irrigation systems is borne mainly by the state (70–80 percent), along with contributions from the end users or local governments (20–30 percent). Large systems receive the highest level of state support (80 percent), with users or local government bearing 20 percent of the cost. Now that the country is a member of the EU the development of irrigation systems is largely subsidized by the Rural Development Programme, which has provided a new impetus for irrigation development. However, most countries in the Western Balkans are making considerable investment in the sector. Albania has spent €220 million in the period from 2000 to 2011, equivalent to some €20 million per year. Figure 4.3 shows the broad breakdown of expenditures over this period. In Bosnia, the main source of financing during the last 8 years has been the World Bank Irrigation Development Project, with a budget of $40 million (€36 million),

FIGURE 4.3 Public expenditure on irrigation and drainage in Albania



Source: Ciko 2012.
Note: O&M = operation and maintenance.

which represents an annual expenditure of €4.5 million. Investments in new irrigation projects were reported to be on the order of € 8,000–9,000/hectares.

In addition to investments from state budgets, several different types of fees are present across the region, but the way they are applied in each country is highly variable. These include the following:

WATER CONCESSION FEES

Authorization for the exploitation of water sources needs to be obtained from the relevant authority. This is given in the form of a concession or permit agreement, but this concession has administrative costs that governments try to recover through the application of this fee. Normally the concession fee consists of a one-time charge, making it different from annual and volumetric fees. This type of fee is applied in most countries but considering that the number of occasions in which it is applied is relatively small, and that the amounts charged are also small, the total amount collected has little or no impact on recovery of the sectors' expenditures.

WATER USE FEES

In Croatia the Water Management Financing Act has established that all water users abstracting water must pay a fee. Normally the water use fees are set to establish the scarcity value of the resource, and to encourage its rational use. This charge is paid by all users of water, including those of irrigation systems. It is also applied to groundwater users since groundwater is a public resource. The water use charge must be paid by any legal and/or physical persons who are abstracting and pumping water from its natural sources, regardless of the purpose for which it is used. The payment is made according to the water quality classification. It ranges from €0.10/m^3 for Class 1 water, to €0.04/m^3 for Class 4. Its application for a consumption of 2,000 m^3 of Class 2 (€0.09/m^3) is approximately equivalent to €20/ha. This water use fee is also prescribed by law in Albania, but it is not applied in practice, and several municipalities are not even aware of the need for its payment. Considering that the irrigation service fee is specifically designed to recover running costs, one could interpret this fee as having the purpose of recovering some of the capital costs.

IRRIGATION SERVICE FEES

These are fees that are set to recover the costs of operation, maintenance, and administration of the irrigation systems. In principle they should recover the full cost of managing the system, but this is rarely the case. Rate of recovery of this type of fee is generally low, rarely reaching 50 percent.

DRAINAGE FEES

Drainage systems cover much larger areas than irrigation systems, and the recovery of their regular costs represents an important source of income for the public companies that manage them. Many of the problems outlined for irrigation fees also apply to drainage fees; for instance, the fees rarely cover more than 50 percent of the actual costs. However, the rates of recovery in Serbia and Croatia are quite high and are an indication that some of the regulatory problems related to irrigation service fees have been resolved. Drainage fees in Serbia range between €10 and 15 ha/year.

LAND TAX

The land tax is essentially a property tax that intends to correlate the value of the land with the tax imposed. For this purpose, land is classified according to its theoretical value, and the tax is proportionally imposed according to the categories assigned. In Albania, annual land taxes range from €10/ha to 30/ha, and are much lower than those for buildings and infrastructure. As this fee is applied on all agricultural land, it constitutes an important source of income. Normally part of the fee goes to the central government (a 50/50 share is common), and the rest remains in the municipality. Municipalities use the land tax for a variety of purposes, including financing part of the regular I&D costs, but it is also used for other activities. The rate of payment is relatively high, often exceeding 60–70 percent.

OTHER LESS FREQUENTLY APPLIED FEES

The above-mentioned fees are the most common ones, but in some countries special fees are applied. In Albania a “greenhouse fee” is applied to all greenhouses. In Croatia the “construction fee” is also foreseen in the law and sometimes applied to the construction of irrigation systems.

Overall, a considerable number of instruments exist for recovering some of the expenditures made in the sector, but in general their application results in low levels of payment; therefore, their contribution to financing the sector is modest. This underscores the need for reforms to increase the level of recovery for irrigation service fees, as well as other types of fees.

LESSONS LEARNED AND NATIONAL POLICY PRIORITIES

Over the past 30 years or so, the World Bank has been engaged in several I&D rehabilitation projects in the region, including four in Albania, one in Serbia, North Macedonia, and in Bosnia and Herzegovina, respectively.[6] Overall, investing in improving I&D systems is economically beneficial if the costs and benefits are adequately measured. Table 4.1 provides a list of the main rehabilitation projects financed by the World Bank in this region since 1994. Total investments were $278 million; irrigation projects covering on the order of 276,000 hectares benefited, with an almost identical figure of 280,000 hectares that benefited from drainage improvements.

The figures presented in table 4.1 provide a first indication of the importance of the I&D rehabilitation needs in the region; however, it is important to note that these projects represent only a fraction of the actual need for investment in the sector. In addition to the World Bank projects mentioned above, many others have been financed by other financing institutions, including the International Fund for Agricultural Development (IFAD), the United Nations Development Programme (UNDP), the EU, and bilateral donors, plus the respective countries' own efforts.

The World Bank has been engaged in several drainage rehabilitation projects, in Albania, Serbia, and Bosnia and Herzegovina. The *ex-ante* economic analysis for the Serbia Irrigation and Drainage Rehabilitation Project projected an economic internal rate of return (EIRR) of 46 percent for the base case, and a lower bound of 40 percent in the sensitivity analysis, though outcomes in practice were not measured. This suggests that investing in improving drainage systems can be quite an attractive economic proposition, though the actual costs and benefits should be measured.

One of the main lessons learned from the experience of the World Bank investments in I&D is that most of the countries of this region have been unable to adequately maintain their I&D infrastructure since the political transition, and this has resulted in the need for major rehabilitation investment projects. However, investment in rehabilitation work has coincided with the fundamental issue of the financial sustainability of the institutions responsible for irrigation rehabilitation, maintenance, and operation since the income from irrigation tariffs is considerably less than the actual O&M costs. The consequences of this usually result in delayed maintenance, leading subsequently to progressive deterioration of

TABLE 4.1 Irrigation and drainage rehabilitation projects financed by the World Bank since 1994

Title	Board approval date	Closing date	Budget	Area objectives	
				Irrigation	Drainage
Albania					
Irrigation Rehabilitation Project (P008270)	September 1994	June 2001	$38 m	80,000 ha	90,000 ha
Irrigation and Drainage Rehabilitation Project (P043178)	June 1999	March 2005	$40 m	50,000 ha	50,000 ha
Water Resources and Management Project (P082128)	June 2004	December 2009	$34 m	50,000 ha	30,000 ha
Water Resources and Irrigation Project (WRIP)	November 2012	May 2018	$35 m[a]	40,000 ha	
Additional financing for the WRIP project	June 2018	June 2020	$21 m		
Total for Albania			$168 m	220,000 ha	170,000 ha[b]
Bosnia and Herzegovina					
Irrigation development project[c]	Approved in 2012 but operational in 2013	May 2020	$39 m	9,000 ha	4,000 ha
North Macedonia					
Irrigation rehabilitation and restructuring project	1997	2007	$38 m	47,000 ha	
Serbia					
Serbia irrigation and drainage rehabilitation project	June 2005	May 2014	$33 m[d]	3,000 ha (new irrigation)	(276,840 ha[e]) 105,525 ha
Total			**$278 m** (» € 250 m)	**276,000 ha**	**279,525 ha**

Source: Goss et al. (forthcoming).
a. Includes $4 million financed by Swedish International Development Cooperation (SIDA).
b. The actual implementation exceeded the project objectives. By the end of 2011, 236,400 hectares of drainage systems were already rehabilitated (Ciko 2012).
c. This included new irrigation areas and the rehabilitation of existing ones.
d. Expanded in 2007 to $72 million to include a large flood control component.
e. The area implemented was smaller: 105,525 hectares, mostly due to emergencies caused by large floods in the country, and the consequent enlarging and restructuring of the loan.

the system up to the point where it becomes unserviceable. All of this leads to the classic rehabilitation-dilapidation-rehabilitation cycle, of which many examples exist in the region.

Irrigation in the region typically brings an annual benefit of around € 1,000/ha[7]; if this benefit were reduced by just 10 percent over a 25-year period due to reduced efficiency, it will have

had a cost of around € 2,500/ha, some four to five times the cost of the rehabilitation works. If 60 percent of the total investment in table 4.1 had been allocated to irrigation rehabilitation, the average rehabilitation cost would have been around €500–600/ha. Thus, whenever irrigation fails completely, a single year's agricultural losses will cost more than the initial investment in rehabilitation, due to the lack of proper irrigation from deteriorating systems. This also applies to the rehabilitation of drainage systems, with the difference that production losses due to waterlogging are generally lower than those due to the lack of irrigation[8]; on the other hand, the areas covered by the drainage systems are much greater than those covered by irrigation, and the maintenance fees are also lower.

The emerging conclusion from the above is that projects that rehabilitate dilapidated irrigation systems are necessary to increase the supply of surface irrigation for farmers; but the rehabilitation/dilapidation/rehabilitation cycle needs to be broken, because it has strong negative effects on agricultural production, income base, and the potential for rural poverty reduction for the countries of this region. Although World Bank projects have made progress in the rehabilitation of the I&D systems, new approaches are required to break this cycle. In the coming decades, with intensifying and more frequent hydroclimatic extremes due to climate change, the role of irrigation will become even more critical in enabling farms to transition from rain-fed conditions to irrigation. However, although rehabilitating I&D systems and focusing on service delivery for modernization, maintenance, and operation of multiuser systems is necessary, it is ***not sufficient*** to enable the Balkan countries to transform their agricultural sectors. Rethinking is needed regarding the way irrigation investment interventions are designed, to reduce negative environmental impacts and promote green and resilient growth of agriculture. This is particularly true for future investment projects, and for systems that have been rehabilitated, to avoid a repeat of this costly cycle. **Much progress has already been made, as many countries have undertaken policy and infrastructure investments in the sector (see table 4.2). But more needs to be done.**

To catalyze a transformation toward more climate-resilient, green, and productive agriculture at scale, this paper presents the I&D (eco)system approach, which directly aligns with the World Bank's emphasis on supporting countries to "build back better." The Bank's current emphasis for recovery efforts is on *green, resilient, and inclusive development* (GRID). GRID scales up and accelerates support for countries to pursue the expansion of digital and green economy solutions, the stimulation of inclusive value chains, and the saving of viable firms and associated jobs. GRID specifically emphasizes ***climate change***, and a deepening of support for national climate and biodiversity action plans. The Bank is also targeting finance toward opportunities to scale up green infrastructure, strengthen climate resilience and capacity at the local level, and build monitoring systems that can identify emerging risks and issue early warnings that can then be integrated

TABLE 4.2 Summary of country-specific objectives and strategies for the irrigation and drainage sector in the Western Balkans

Country	Irrigation infrastructure	Drainage	Other
Albania	The **Albanian National Strategy for Irrigation Drainage and Flood Protection** sets the framework and the following key goals: **Irrigation** (Estimated investment cost $253.6 million). This will include: • Rehabilitation, completion, preservation & decommissioning of dilapidated multiuser irrigation systems, which at present are not functioning, or only partially functioning • Restore the 360,000 hectares that were previously covered. • Measures for increasing the sustainability of the existing large irrigation system by improving the financial management and the sustainable O&M of irrigation systems.	• **Drainage** (Estimated investment cost $56.3 million): Focus on the replacement of old and inefficient heavy equipment used for cleaning of the main drains and improving the financial recovery of maintenance drainage costs.	**Dam Safety & Operations** (Estimated investment cost $130.2 million): Aims to restore the capacity of reservoirs from their current average of 55 percent, to initial design capacity, through massive silt removal or other engineering solutions. • Improving dam safety standards consistent with EU standards for existing dams • Decommission approximately 70 dams that are at risk of failure or have no economic value in re-establishing their storage capacity. **Flood protection** (Estimated investment cost $166 million) • Aims mainly to reduce the potential of flood damages to less than 50 percent of the current potential • Rehabilitation and modernization of all flood protection infrastructure that has deteriorated and at imminent risk of failure • Construction of additional flood protection infrastructure, focusing on flood-prone areas
Bosnia and Herzegovina	**Strategic Plan for Rural Development of BiH (2018–21)** Framework represents the main planning document for development of the water sector. • For the **Republika Srpska**, irrigation potential development is estimated to be around 158,000 ha. • The government of the Republic of Srpska has adopted a Strategic Development Plan for agricultural and rural development for the period 2016–20, which provides monetary support for irrigation system investment (communal and individual), with the aim of increasing irrigated area by 10,000 ha by 2020.		

(continued)

TABLE 4.2 Summary of country-specific objectives and strategies for the irrigation and drainage sector in the Western Balkans *(continued)*

Country	Irrigation infrastructure	Drainage	Other
	• For the **Federation of Bosnia and Herzegovina,** the lack of irrigation is one of the main production limitations for agricultural crop cultivation in the Federation of BiH. • Detailed survey of the current situation of the irrigation systems is planned, and eventually an increase to 30,000 ha of agricultural land area covered by irrigation systems is foreseen by year 2021, which would make up 4 percent of arable agricultural land in the Federation of BiH.		
Croatia	• **National Program of Irrigation and Management of Agricultural Land and Water in the Republic of Croatia** was adopted in 2005 as a framework for future I&D activities • All counties have developed County Irrigation Plans considering local natural conditions, and social and economic background • The long-term vision of the plan is the development of 65,000 ha equipped with irrigation infrastructure • An important element is the emphasis placed on environmental protection, particularly when it comes to irrigation development	In addition to the 1.0 million ha that are covered by drainage systems it has been estimated that 620,000 ha need drainage systems, and in some cases, related flood protection measures.	
Kosovo	• Under the recently approved **Kosovo Irrigation Master Plan (2020), focus is on the short-term rehabilitation of irrigation infrastructure**	• The planning process developed under the Kosovo Irrigation Master Plan has evidenced that over a theoretical potential of 280,000 ha, 136,000 ha shall be retained for development, out of which 107,000 ha shall be given secure access to water downstream from multipurpose reservoirs.	

(continued)

TABLE 4.2 Summary of country-specific objectives and strategies for the irrigation and drainage sector in the Western Balkans *(continued)*

Country	Irrigation infrastructure	Drainage	Other
	• In the short and medium term, the action plan identifies a list of key priority projects to prioritize the investment for the short-term projects, and part of the medium term over a gross area of 72,000 ha • In the medium term the focus is on new irrigation systems, followed by rehabilitation		• Complementary measures include the development of a global water investment program, supported by key institutional and regulatory reforms as the enabling environment to foster the development objectives of the irrigation plan and the agriculture sector.
Montenegro	• In 2016, the Ministry of Agriculture and Rural Development of the government of Montenegro (MARD) has envisioned that by **2025 irrigation systems were to be built to cover 80 percent** of the 74,090 ha of land suitable for irrigation and 100 percent by 2035 (Bulatovic & Rajovic 2018) • The private sector has been much more active in the development of private irrigation systems, which represent most of the irrigated area		• There is a need to help farms restructure and upgrade their agricultural production standards. • Need for satisfying EU compliance requirements on food safety, environment, and animal and plant health. • Investments in the sanitary and phytosanitary (SPS) system is needed to improve food safety conditions and expand access to export markets. • Improvement and development of rural infrastructure and services is another important step. • Extension services also need to develop their capacity in order to reach more farmers and respond to their need for advice.
North Macedonia	• The **Water Strategy (2010) planned investment activities in irrigation development** through noncredit types of financing—focused primarily on:		• There is a need for the preparation of National Irrigation Master Plans.

(continued)

TABLE 4.2 Summary of country-specific objectives and strategies for the irrigation and drainage sector in the Western Balkans *(continued)*

Country	Irrigation infrastructure	Drainage	Other
	• Reconstruction and modernization of the existing irrigation systems • Completion and equipment of necessary new irrigation systems.		• This will also require a detailed assessment of the existing constraints and opportunities, in order to frame interventions in an integrated approach.
Serbia	• The **Water Management Strategy of the Republic of Serbia represents the main planning document** for the medium-term development of the water sector (up to 2034). • For the irrigation sector, the following operational goal was envisaged: provision of sufficient amounts of water to irrigate 250,000–350,000 hectares of agricultural land by 2034. • About 100,000 hectares are covered by existing systems, and 150,000–250,000 hectares will be covered by new systems. • The **National Irrigation Master Plan** is under preparation.		

Source: Goss et al. (forthcoming).
Note: BiH = Bosnia and Herzegovina; I&D = irrigation and drainage; EU = European Union.

into social protection systems. On ***gender***, the World Bank is focusing on scale up of interventions that address the rapid backsliding that women and girls are experiencing on many fronts, build their resilience, and ensure their inclusion in the post-COVID-19 recovery. Regarding ***inclusion***, the pandemic crisis has raised voices calling for greater social inclusion, citizen engagement, and open dialogue, and for creating opportunities to ensure that the recovery leaves nobody behind, including people with disabilities. As for ***digital development***, the GRID approach emphasizes finding ways to close the digital divide so that technology can be a force multiplier for better service delivery and inclusive growth. All of these aspects are highly relevant in rethinking and reforming investment strategies for the I&D sector in the Western Balkans and are incorporated into the proposed I&D (eco)system approach described in the next chapter.

NOTES

1. Albanian irrigation statistics report three types of areas: “potential irrigated area,” “actual irrigated area,” and “factual irrigated area.” This graph shows actual irrigated area, the smallest of the three types since the actual irrigated area is greater than the total reported area of crops. These data are from annual statistics for 2018; the 2012 agricultural census provided the numbers of irrigated holdings, but not land areas.

2. Data for North Macedonia are from its most recent agricultural census, held in 2007. A survey carried out in 2013 indicated that the amount of irrigated area had increased to nearly 74,000 ha.

3. The data for Kosovo are from its 2014 agricultural census. Other data suggest that the irrigated area has since increased markedly, reaching almost 22,000 ha by 2016.

4. The term “grass” refers to grassland, not irrigated lawns or parks.

5. Membership in a WUA requires the necessary legislation governing the establishment and operational roles, responsibilities, and rights of members of WUAs. Therefore, it is important to have a clear enabling WUA Act (or law) in place to ensure mandatory membership of a WUA for farmers in a specific irrigation area.

6. The economics of these projects have been examined, in greater or lesser detail, in the economic evaluations conducted during project preparation. The most complete evaluation is found in the Project Appraisal Document for the Serbia Irrigation and Drainage Rehabilitation Project (World Bank 2005).

7. Detailed assessment of two proposed irrigation schemes for small farms in Central Serbia estimated the benefits at € 900/ha and € 1,100/ha respectively, considering the effects of irrigation on both yields and cropping mix.

8. The Economic Analysis for the World Bank Irrigation and Drainage Rehabilitation Project in Serbia assumed that better drainage would allow some shifting toward higher-value crops and also bring yield increases ranging from around 8 percent for wheat and 20 percent for maize, to around 30 percent for vegetables and 35 percent for fruit.

5

Enabling Green & Climate-Resilient Agricultural Transformation in the Western Balkans: The Irrigation and Drainage (Eco)system Approach

THE IRRIGATION AND DRAINAGE (ECO)SYSTEM APPROACH DEFINED

Irrigation and drainage (I&D) can play a critical role in supporting structural transformation in the agricultural sector; improvement of production efficiencies on farms; and transition to the Green Agenda of the European Union (EU) in the Western Balkans. But to make this happen, a major rethinking is needed. Irrigation is inherently part of a complex socio/technical/ecological system that is influenced and affected by weather, climatic, agroecological, socioeconomic, governance and policy, and human and behavioral factors (Izzi et al. 2021). These factors are what we refer to as the ***(eco)system***[1] of irrigation, and it plays a powerful role in influencing outcomes from investments in irrigation at multiple scales and in multiple dimensions that overlap and interact with each other.

Although investment strategies often focus on the rehabilitation of large-scale public irrigation schemes like canals, reservoirs, tanks, and pump stations, where service performance is necessarily linked to physical criteria, these strategies are traditionally unable to account for, or respond to the dynamic and multiscale nature of the I&D (eco) system. But failure to account for, manage, or invest in these factors can lead to negative impacts on agricultural productivity, environmental sustainability, and climate resilience; or they may only reach a limited segment of the producer groups in the project area, which then reduces the uptake and the potential created from rehabilitated systems. Infrastructure-driven investment strategies also tend to overlook the inherent diversity of the hydroclimatic,

farming, governance, and related rural socioeconomic systems that are influencing irrigation outcomes (Castillo et al. 2007; Lankford et al. 2020; Sinha et al. 2018) (figure 5.1).

For I&D investments to enable the Western Balkans to successfully complete the structural transformation of their diverse farming systems, this report recommends an integrated (eco) systems approach that customizes specific I&D infrastructure ***and*** non-infrastructure solutions at the constraints and needs of the various types of farming systems and diverse agroclimatic zones that are present across the Balkan countries. This customization can potentially better respond to the systemic and cross-sectoral factors that influence and impact outcomes in the irrigation sector.

A rich, 30-year history of engagement has enabled the World Bank to learn some key lessons: foremost among them is that to break the rehabilitate/dilapidate/rehabilitate cycle; ensure optimal use of the I&D potentials created; and respond to the overall economic, environmental, and social goals for end users, there is a need to embrace a holistic, farming system-centered investment strategy. This approach offers a redefined investment framework for identifying, designing, prioritizing, sequencing, implementing, and monitoring I&D sector interventions in a holistic and targeted manner to address agricultural water management constraints for diverse farm types and contexts. It is oriented toward supporting governments in meeting the triple objectives of green, inclusive, and climate-resilient irrigation and agricultural growth.

The main departure of the (eco)system approach from "business as usual" is making a deliberate effort to ensure that optimal use is made of the new or improved I&D drainage potential, by ensuring that investments in I&D are well aligned with the ways in which diverse farm systems use irrigation water. The following principles distinguish the I&D (eco) system investment framework from conventional investment strategies:

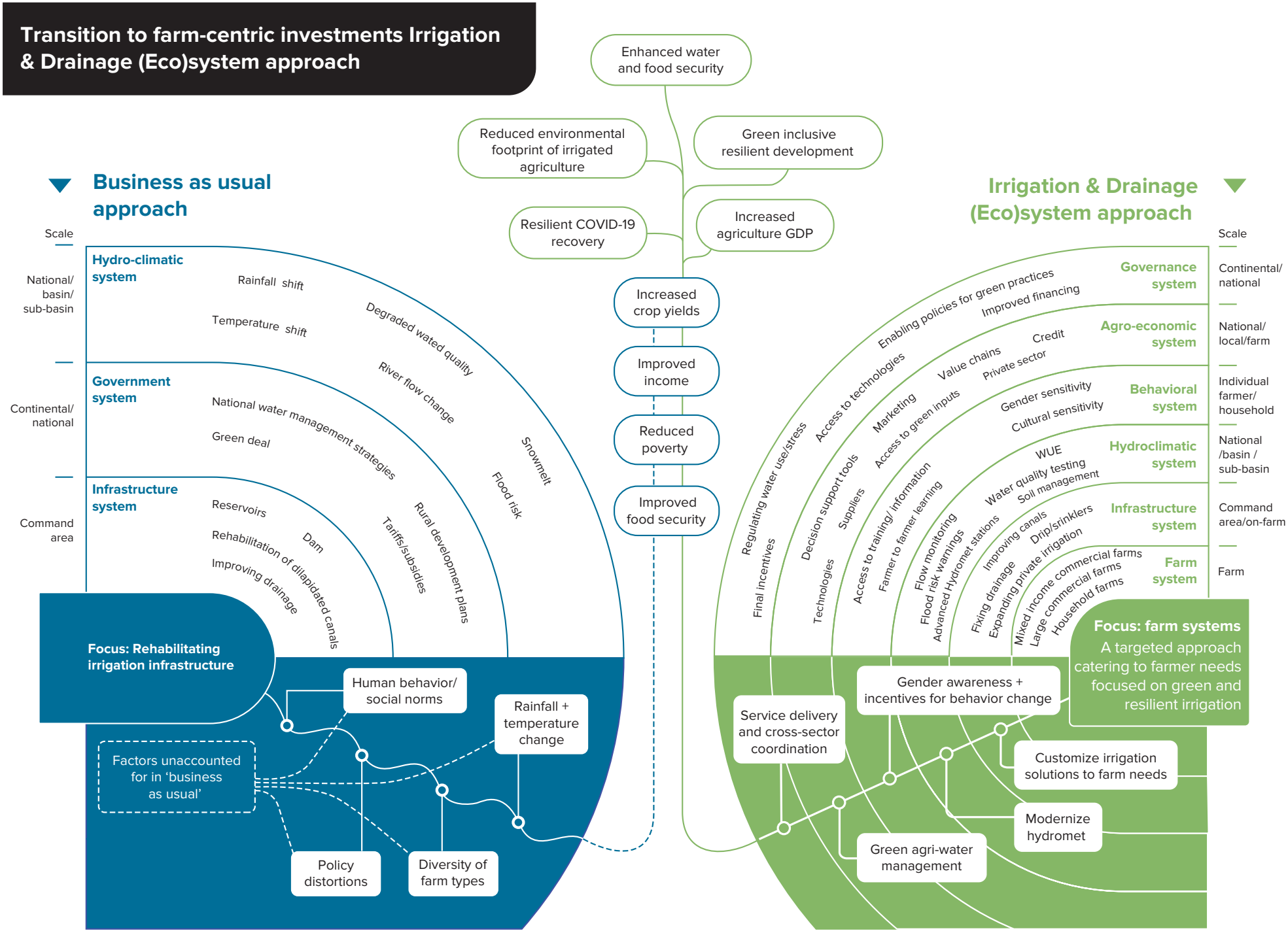
- **A strong "environmental stewardship" approach** that couples all future I&D investments with improved environmental standards and practices that meet the requirements of reduced water pollution and the negative environmental impacts of increased irrigation to align with the Water Framework Directive, the EU accession process, and the Green Agenda policy priorities of the Western Balkans, within a river basin context.
- **A diversified irrigation service delivery model that includes support for private irrigation**. In multiuser or public irrigation systems, a move toward on-demand irrigation water services is encouraged to enable the flexibility, reliability, and adequacy of irrigation water supply. This also includes support for private irrigators who are making investments and innovating to valorize the I&D infrastructure through

conjunctive use of surface and groundwater resources. It focuses on creating clear institutional responsibility, accountability, effectiveness, and regulations.

- **New performance-monitoring standards and metrics of success**, including the identification and application of holistic performance indicators that go beyond physical criteria to include greener agricultural productivity, environmental sustainability, climate resilience, and the flexibility, reliability, and adequacy of irrigation water supply. These standards can set service providers on a path toward providing reliable, safe, inclusive, transparent, and responsive services that align well with the World Bank's ongoing work of developing performance assessment tools for the irrigation utilities of the future.
- **Innovative financing models,** including performance-oriented fiscal transfers to municipalities, results-based financing of individual projects or programs, and the promotion of partnerships at both the local and national levels of administration, to leverage financial resources, harmonize policies, coordinate investments, and ensure the principle of financial additionality.
- **Flexibility in terms of timelines.** The proposed interventions could be short-term (setting the stage for longer-term investments) or long-term, spanning five or more years. For better outcomes, the choice of interventions is grounded in local realities that address what farmers need to better use and manage irrigation water; but this broader lens does not make interventions more complex. By understanding the complexities and leveraging opportunities, simple interventions that deliver high impact at low cost can be crafted.

The I&D (eco)system approach seeks to support a range of farming systems, from small-scale to commercial producers, with tailored approaches to food production that link climate risk management with other forms of risk management, and other market-based mechanisms. It proposes to place farming systems at the center, and targets appropriate ***I&D infrastructure*** and technological solutions to the needs of a variety of farming systems, while also channeling ***non-infrastructure*** interventions at the scheme, farm, river basin, and national levels. This is to try to respond to the disruptions caused by the (eco) system: behavioral distortions, policy distortions, hydroclimatic risks, and related economic constraints. Figure 5.1 illustrates the shift advocated by this approach toward a farm-centered investment strategy, depicted by the "green" right-hand side of the diagram. The "business as usual" scenario is illustrated by the "blue" left-hand side of the figure; here the focus is on rehabilitating dilapidated irrigation infrastructure. The predominant investment strategy is at the center, where diverse human, farming, policy, and hydroclimatic systems are simultaneously driving various disruptions to predicted investment outcomes. (See the bottom right-hand corner of figure 5.1).[2]

FIGURE 5.1 The irrigation and drainage (eco)system approach



Source: Authors.

As a farmer-centric investment model, the I&D (eco)system approach considers at the outset not only *how* farms access irrigation water, but also their available crop choices as well as probable future changes in agricultural markets. It accounts for growing climatic threats to irrigated agriculture and seeks to reduce environmental damage from increased irrigation to embed I&D investments in a broader, green resilience agenda. To customize the right types of infrastructure and non-infrastructure solutions within an investment program, analysis of the needs of different farm types (small household farms, mixed-income, and full-time commercial farms) is necessary during the identification phase of a project. During this phase of exploration, dialogue with key stakeholders in-country, as well as specifically and directly with farmers will be necessary. During this dialogue, the following aspects and queries, and areas of investigation about how to identify appropriate I&D solutions, and the constraints and needs of various types of farms should be considered:

- **Economic aspects**: Is the investment beneficial to the prosperity of a community? What economic value will be provided in general?
- **Irrigation techniques**: What techniques are appropriate to use in each local setting?
- **Irrigation systems management:** How effective is the management structure? (How helpful are the decision support tools?) What do communities identify as their main concerns with existing management structures?
- **Water productivity**: Does the current water use efficiency (WUE) and water productivity (WP) match the available resources?
- **Sociocultural aspects**: What will be the consequences of an irrigation intervention for a community?
- **Appetite for innovation**: Is there willingness and ability among farmers to invest in new technologies?
- **Ecological requirements**: What are the environmental flow conditions? (For example, what is the minimal required discharge in a river?) What environmental services in a catchment will have to be maintained, and how will these dynamics be impacted after new I&D systems are operational?
- **Administrative aspects**: What authorities or institutions are currently overseeing water distribution and control? Is there water user organizations (WUOs) or other local level community groups? Are there institutional or community-based systems to support farmers so they can receive timely and adequate irrigation water? For private irrigators, what are the key institutional constraints that can be addressed by an investment?
- **Legal aspects**: What water rights exist? Who possesses ownership of the land? What general legislation exists? What is the status of land ownership?

It is important to understand that investments in large-scale public irrigation schemes are public goods, which are traditionally under the domain of the water sector; while on-farm irrigation is considered private and is supported by agricultural or rural development policies. The sectoral silos associated with the irrigation, drainage, and agriculture sectors can lead to a disconnect between scheme-level physical infrastructure interventions and agriculture, which is focused on farm or field-level interventions. This disconnect presents a major obstacle in the Western Balkan countries due to weak alignment of the sectoral investment strategies. **The (eco)system approach depicted in figure 5.1 aims to break this disconnect by proposing stronger harmonization and integration in how interventions are designed across sectors, across varying systems, and across multiple scales of intervention, with the central purpose of targeting interventions to align with a variety of farm system needs.** However, echoing the World Bank's recently published *Farmer-Led Irrigation Development Guide*, it is important to note that a pragmatic approach is needed, and no intervention should be made to change "things that are not broken" just because they are less than perfect, or do not fit conventional experience (Izzi et al. 2021).

To operationalize the (eco)system approach, this paper proposes six implementation areas. To fully respond to the constraints highlighted in chapters 2, 3, and 4, as well as to meet the needs of the three main types of farming systems in the Western Balkans, six areas for operationalizing the I&D (eco)system approach are recommended.

OPERATIONALIZING THE (ECO)SYSTEM APPROACH: SIX AREAS OF IMPLEMENTATION

IMPLEMENTATION AREA 1: STRENGTHENING I&D GOVERNANCE STRUCTURES, IRRIGATION SERVICE DELIVERY, AND MANAGEMENT THROUGH MULTIAGENCY COORDINATION

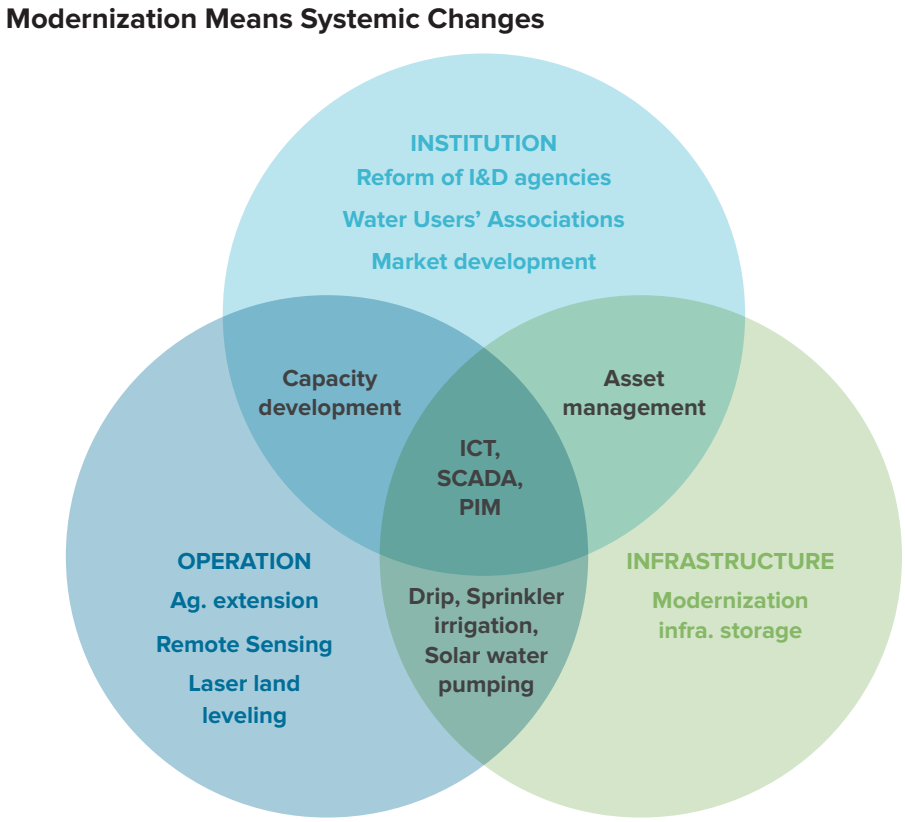
To align with the irrigation needs of diverse farming systems, and to improve the performance outcomes of I&D investments in multiuser systems in the Western Balkans, modernization[3] of irrigation service delivery functions and diversification of infrastructure options are necessary. One of the main reasons for the underperformance of large and medium-scale irrigation projects in the Western Balkans is the lack of integration between the engineering and design, and financial and institutional aspects of the projects, and the service delivery models. This set of recommendations aims to address Constraint #7 (weak governance and service delivery functions of key irrigation and water management agencies), and Constraint #8 (the long legacy of malfunctioning or completely nonfunctioning I&D infrastructure and underfunding of I&D systems operation and maintenance).

Implementation Area #1 recommends channeling investments to modernize the performance of the main service providers in the Western Balkans (public sector agencies, I&D directorates, and/or public/private utility companies) and to ensure that their service provides inclusive, equitable, reliable, and flexible I&D solutions to farmers both on-farm and off-farm.

Invest in reforming irrigation institutions and enhancing performance through modernization, and innovative measures for service delivery through a focus on responding to diverse farmers' needs by increasing accountability, creating autonomy in the service delivery chain, and separating functions. Traditionally, along with the problem of the existing irrigation systems' tendency to perform below potential, I&D initiatives have failed to undertake a service-delivery approach. This has been in part due to weaknesses in the local institutional set-up, in which services to diverse farming systems are typically not flexible; often there is also untimely supply of water (low reliability), and a low level of WUE. This report has detailed how I&D institutions in several of the Balkan countries are stuck in a low-level equilibrium trap with consistent issues of (1) a top-down, engineering-driven management mindset that is not oriented toward providing reliable service to diverse farm segments; (2) obsolete infrastructure and insufficient financing for management, operation, and maintenance (MOM); (3) weak capacity to deliver services that farmers are willing to pay for; (4) limited data on which agency should manage the I&D sector in the country; and (5) weak incentive to change the status quo. To address these root-cause issues, this intervention area recommends some of the following measures for reforming service delivery for countries to consider.

- **Improve System Management**
  - Develop and implement a systematic approach to performance measurement and reporting, including improved water accounting, to increase transparency and accountability as well as develop a customer service mindset and the efficiency of service providers.
  - Develop and implement integrated business plans for public service operators and WUOs, to improve both the autonomy and accountability of service providers.
  - Define clearer separation of responsibilities down the service value chain between water providers, landowners, and regulators.
- **Increase System Flexibility and Resilience**
  - Increase the flexibility of the irrigation system to better meet the changing demands of farmers through a greater focus on modernization as opposed to rehabilitation (see figure 5.2).
  - Improve the efficiency and customer service delivery of service providers by recognizing that household farms, mixed-income, and full-time commercial farms have different priorities, budgets, and access to irrigation water.
  - Build a culture of internal and external accountability, efficiency, and customer orientation.

FIGURE 5.2 Components of irrigation modernization



- Modernization is to provide farmers with sustainable, efficient and demand-responsive water delivery service. Actual modernization interventions need to be tailored to each irrigation schemes with different climatic and physical settings, and cropping and farming practices.
- When designing irrigation modernization interventions, agricultural, social and institutional requirements need to be taken into account.

Source: World Bank (2019).
Note: I&D = irrigation and drainage; ICT = information and communication technology; SCADA = Supervisory Control and Data Acquisition; PIM = participatory irrigation management.

- **Build Capacity and Partnerships Between Public & Water User Institutions**
  - Strengthen the technical capacity of public service providers through advanced staff training and the creation of a professional working environment with performance-based incentives, to improve the delivery of I&D services to customers.
  - Strengthen the partnership between I&D service providers and WUOs in those Balkan countries where WUOs are still active; or with other farm-level agencies, to improve efficiency and service quality from the scheme to the farm.
- **Improve Cost Recovery**
  - Develop policies and approaches to better understanding costs, tariff structures, and subsidies, as a foundation for improved cost recovery and financial autonomy.
  - Explore partnerships with the private sector for simple opportunities to reduce annual O&M costs and improve cost efficiency.

Build irrigation service delivery agencies of the future by assessing their performance using green, resilient, inclusive, and gender-sensitive service delivery indicators; and by addressing the information gaps that could help to support farmers as they transform their productive capacities. Irrigation service delivery requires the availability of water and an adequate infrastructure; that is, one that is functioning above the minimum thresholds. To ensure its success, it also needs enabling institutional arrangements and sufficient human capital. To deliver services, organizations require adequate resources and effective governance at both the local and higher levels. In all situations, the level of service that is provided must grow out of consultations with users themselves, not be unilaterally imposed by a higher-level irrigation agency or operator. An appropriate and clearly established level of service contributes significantly to improved water delivery outcomes in terms of flexibility, reliability, and equitability throughout the irrigation area.

Irrigation service reliability is defined as the extent to which the irrigation system and the related delivery of water conform to what users expect from the system (Waalewijn et al. 2020). As highlighted by Constraint #4, irrigation service providers in the Western Balkans have limited awareness of the water consumption patterns of farmers using different irrigation techniques (for example, flood irrigation vs. drip irrigation), as well as in different climate scenarios with different types of crops. This means that irrigation agencies often are not able to develop irrigation MOM plans that are compatible with fluctuations in river flow, and changes in farmer demand due to cropping needs; this reduces the reliability of the service. Thus, it is important to invest in technical capacity, human resources, and skill building so that irrigation agencies can collect, analyze, and respond to changes in water use and changing crop choices and cropping intensity. Performance assessment is another important management tool in providing I&D services. ***Performance assessment is the process by which the level of service in a specific area, defined by an agreed-upon set of measurable performance indicators, is evaluated.*** According to Waalewijn et al., the critical areas for performance assessment can include adequacy of supply, reliability, equity, flexibility, productivity, operability, financial sustainability, asset management, technical operations management, organizational management (HR), fiduciary management, transparency and customer orientation, accountability, and inclusive representation, among other things.

As the emerging priorities for enhancing climate resilience and the EU Green Agenda become grounded in greener agricultural water management practices, the performance indicators against which irrigation service agencies are measured must also be reconsidered to incorporate metrics adapted to the goals of enhanced green agricultural growth, and reduced pollution from I&D investments: these are the basic foundations of

the I&D (eco)system approach. Thus, additional indicators that can be considered include: (1) the quality of systems in place to measure and monitor the volumes of water used in agriculture in selected irrigated areas and at various scales; (2) the number of farms that are adopting additional WUE practices after trainings provided by an irrigation service provider; (3) the degree to which concession fees incorporate environmental and resource costs (by using a "polluter pays" methodology); (4) the type and adequacy of water pricing policies in place to incentivize sustainable water use; and (5) the degree to which treated wastewater is used for irrigation in certain areas or at times of water stress, and other measures used to adopt a circular economy approach in I&D.

In addition, it is vital that service providers are also measured on how well they are fulfilling their role as modern irrigation water service providers through improved customer service, including gender-inclusive citizen engagement interventions. Revised service delivery performance indicators will need to be determined at the national, river basin, and local levels, in close consultation with farmers and other I&D, agriculture, and related actors to determine the type, degree, and adequacy of new potential indicators for each specific country context. If selected key indicators are compiled and forwarded at the central level it will constitute a decision-making tool that will help to identify those systems that require attention, and thus to prioritize the most important actions. Such a monitoring system was recently installed in Albania under the World Bank's Water Resources and Irrigation Project (WRIP), using geographic information system (GIS) capabilities; it is still in the initial pilot stage, but preliminary results are encouraging. Finally, asset management is vital as a basis for benchmarking performance and for understanding and segmenting I&D infrastructure, MOM costs (depending on exposure, durability, risk, and so on). This kind of assessment is fundamental in developing irrigation service fees (ISF), which underpin the financial sustainability of systems, as well as for providing a business-oriented service; and it is highly pertinent to both customers and service providers (Waalewijn et al. 2020).

Break sectoral silos and create multi-ministerial coordination bodies that include decision makers from the water, irrigation, agriculture, rural development, finance, and planning ministries to enhance regulatory and policy coordination. To address **Constraint #1**, which points out that national policy responses to the agriculture and irrigation sectors across the Western Balkans are fragmented, with limited mechanisms for multiagency coordination, this report recommends creating coordinating bodies among the agencies engaged in the water, food, land, and energy sectors, building on the examples of the multisectoral coordination mechanisms that already exist in Albania and Kosovo. In addition to better integration and joint effort among multiple ministries, there is a need to align policy interventions as new information about the consequences of investments

is gathered over time, and as other variables related to the social, political, hydrological, and economic systems shift within rural, urban, and sociopolitical contexts. This may entail delaying some infrastructure projects, and phasing in various policy or incentive mechanisms prior to commencing engineering works.

To meet the legal requirements of implementing the EU's WFD and related directives, innovative and multifaceted governance and regulatory reforms will be required; these can be supported by future I&D (eco)system operations. In addition to the very rigorous and complex standards and specific requirements of the WFD, the WFD will also require all of the Western Balkan countries to develop additional specific legislation on pollution, particularly on measures to prevent and control the groundwater pollution that can result from increased irrigation intensity after infrastructure systems are upgraded. Another important feature of the WFD is the requirement for public participation. To adequately meet these objectives, future (eco)system operations can support governments in developing an integrated legal, regulatory, and participative "Common Implementation Strategy," which can help countries develop detailed rules and procedures concerning any I&D infrastructure investment.[4] The process of developing a comprehensive strategy may constitute new governance reforms that will be needed to better monitor and comply with regulatory requirements regarding water quantity and quality. It can also include metrics to measure progress; scoreboards; horizontal networking and information pooling; river basin management plans; nonbinding guidance documents produced collectively by the appropriate line agencies and I&D service agencies, with input from experts; as well as specific requirements for stakeholder and public participation in all aspects of implementation (Trubek and Trubek 2007).

There can be adverse environmental impacts even from "green" technological and irrigation solutions; these must be mitigated through a combination of regulatory instruments and metering options (Malago et al. 2021). Potential technological solutions for greening irrigated agriculture include solar groundwater pumps and the adoption of precision irrigation technologies. However, the widespread use and adoption of these technologies may increase groundwater abstraction (from the solar pumps or other means); or it may increase consumptive water use from drip systems at the basin scale (Fishman, Giné, and Jacoby 2021). To mitigate against any potential negative environmental externalities resulting from technological investments, it is recommended that water and environmental diagnostics be conducted before, during, and after such interventions. This will entail testing the existing water balance and adhering to the minimal biological requirements of waterways as well as local ecosystem/biospheres; this activity can be effectively led by a multiagency policy and regulatory coordination body. It may also

involve community monitoring of water use, soil, and crop management practices, as well as the introduction of regulatory measures like pumping controls, or permits for water use. A multiagency coordination body can also introduce caps on water use in areas where drip and sprinkler irrigation will be promoted at scale; permitting and licensing groundwater abstraction in areas where private irrigation will be promoted at scale; incentivizing green production standards; reforming irrigation tariffs and reducing subsidies; promoting easing in the restrictions against agriculture off-takers connecting directly with farmers; and other related agricultural investments in value chains and marketing. In areas where solar pumping is to be promoted, additional checks on volume pumps as well as feed-in tariff solutions, and regulation on the placement of panels to preserve landscapes, ecosystems, and the health of arable land will be required. However, regulation often is not sufficient to prevent over-abstraction of groundwater once solar technologies are introduced; thus, this solution should only be promoted in combination with recharge net metering,[5] with an appropriate fee structure that will provide farmers with an incentive to use groundwater more efficiently, and with the overall objective of encouraging the environmental stewardship of natural resources among both water users and irrigators.

IMPLEMENTATION AREA 2: GREEN AND DECARBONIZE IRRIGATED AGRICULTURE

To enable the Western Balkans to meet the requirements of the Green Deal, transition toward rehabilitation of their natural resource capital is recommended. Constraint #2 in chapter 2 stressed that "investments in irrigation and drainage infrastructure across all of the Western Balkan countries are rarely coupled with environmental regulations to reduce pollution and avoid damage to eco-systems, with weak focus on incentivizing greener and decarbonized agriculture water management practices." To address this constraint, there is a need to change from the overemphasis on infrastructure rehabilitation and move toward a broader approach that sees irrigation as rooted in modern, basin-scale as well as on-farm agricultural water management practices. This implies practices that are fully focused on restoration of the natural capital, as well as on creating a green infrastructure of entire landscapes that is aimed at enhancing the provision of higher-level goods and services and is customized to a variety of types of farming systems. This intervention area recognizes that the introduction of additional irrigation capacity can coincide with negative externalities for the ecological health of river, soil, land, and groundwater resources stemming from excessive water use, or unsustainable farming practices. Therefore, to align with the more stringent requirements for farming, food production, water quality, biodiversity protection, and wastewater reuse in irrigation promoted by various EU policies,

this calls for the development of an environmental stewardship approach in the Western Balkans that will further strengthen existing measures to monitor, manage, reduce, and regulate the adverse environmental impacts from I&D services, and related agricultural production.

Investments are needed to repurpose some of the existing irrigation systems, and to catalyze nature-based solutions, power generation, pollution prevention, and agricultural water management. Most I&D infrastructures have little operational flexibility in responding to changing needs: both on the downstream side, to farmers' needs, and on the upstream side, to the needs of river basin management such as reservoir management, flood protection, and other preventative functions. Thus, the first step in this intervention area is to evaluate the options for each agroclimatic zone, and within each zone for each farming type; that is, which investment is most needed to catalyze greener irrigation in the region. This might involve, for example, evaluating whether rehabilitation of multiuser I&D systems; development of new I&D systems; rehabilitation of drainage systems; or partially or totally financing the development of irrigation systems in large private companies (formerly *agro-kombinats*) is the most appropriate approach. It can also entail evaluating options such as promoting pressurized pump irrigation, introducing solar energy for groundwater abstraction, and/or introducing precision irrigation that can control the delivery of fertilizer to reduce overapplication, and the consequent pollution of river systems. This can also be coupled with investments in drought-resistant and other types of crops and production methods that will adapt to changing climatological conditions. Other potential solutions include using irrigation lands as inundation ponds; using drainage channels to evacuate storm floods (for example, Shkodra in Albania); and creating wetland buffers rather than canalization for flood protection. This type of solution would entail repurposing so that irrigation schemes could enhance the ecological status of lagoons and inland lakes, rather than polluting or depleting them. (This has been done in Divjaka in Albania, as well as in the Butrint lagoon). The Western Balkans are particularly well suited to using irrigation in eco-agronomic farming, to help preserve cultural landscapes while fulfilling multiple purposes such as restoring old ponds and waterways, providing drinking water, creating tourism around reservoirs, and creating urban green spaces and recreational areas where canals cross major agglomerations.

Consider circular economy approaches to the adoption of wastewater reuse for irrigation. Transition to a circular economy model could create significant synergies for the wide adoption of water reuse as an alternative supply of water for irrigation in the Balkan countries, especially considering the EU Wastewater Directive and its requirements for using treated wastewater for irrigation. Findings from recent studies show that many of

the barriers water reuse is facing, ranging from public perception to pricing and regulatory challenges, can be addressed effectively through promoting and developing a wider circular economy perspective (Vouvoulis 2018). Transition to a circular economy will encourage more efficient use of water, combined with robust incentives for innovation, and can enhance the ability of governments to handle the demands of the growing imbalance between water supply and demand. ***Recycling and reuse are central to a circular economy approach; they offer a strategy for improving water supply by managing wastewater better. This strategy should be considered for the agricultural sector in the Western Balkans.***

Consider decarbonization interventions through improved water management, and controlled drainage for the promotion of soil health in irrigated agriculture through investments in upgrading drainage systems. To harmonize with the EU's Green Deal, regional soils can provide an excellent sink for carbon sequestering, by which the soil organic carbon (SOC) is restored over time. In association with other soil conservation interventions, repurposed drainage system design and management aimed at better soil moisture (and temperature) control would give these systems a fundamentally different scope. This would significantly increase the region's decarbonization efforts, while focusing on agricultural water management techniques as a way to support farmers in improving their cropping and water use practices in specific agroclimatic zones and farming typologies. Traditional drainage system management implies simply letting the system run continuously without any control; but control is necessary in order to prevent waterlogging and soil salination, and is also the practice used during the leaching of salinized soil. However, management measures are needed to regulate flow and reduce the impact of saline drainage water on the environment (Ayars, Christen, and Hornbuckle 2006). Thus, there also needs to be a transition from no management at all, or only passive management, to active or "controlled" drainage management, with well-defined water management objectives. The goal of management may be to reduce total drainage flow, reduce contaminant load, improve irrigation efficiency, stabilize soil carbonization processes, or some combination of these outcomes (Ayars and Schoneman 2006). Active management of a drainage system, and the position of the water table will contribute to each of these goals. This is particularly relevant for the Vojvodina region in Serbia, which has experienced soil degradation stemming from irrigation-related activities (box 5.1).

To green and decarbonize irrigated agriculture it is important to customize farm advisory services toward the adoption of new crop varieties that can adapt to climate stress; targeting small producers, women decision makers, and other water user groups; and focus on environmental stewardship and the promotion of climate-resilient agricultural

BOX 5.1 Case study: Vojvodina

The Vojvodina region in northern Serbia spans an area of 2,150,000 hectares (ha), of which 73 percent is arable land (1.58 million ha). Two thirds of the arable land in this region is endowed with soils of the Chernozem type; these are deep, black soils, which have a high fertility potential. The entire system has been developed as a hydromelioration scheme, which involved the construction of dikes and a network of canals, open collector drains, and pump stations. Along with systematic hydromelioration works in the past, the removal of natural riverine forests and woodlands has played a key role, which has aggravated today's land degradation and sustainability problems. A recent FAO study of the soils in the region revealed low levels of soil organic carbon (SOC) in 40 percent of the samples. The typical SOC concentrations of these soil formations ranges between 6 percent and 9 percent. The loss of SOC is seen as being caused by inadequate agricultural practices, increased wind erosion, and poor water resources management.

water management practices. This type of effort currently does not exist across the Western Balkans. Thus, this intervention area focuses on developing farm and field-scale interventions to incentivize farmers to become environmental stewards by adopting water efficient agriculture practices. This can complement investments in green irrigation technologies and renewable energy and can help scale the adoption of climate-resilient crop varieties. But first, it is important to invest in farmer education through both gender-disaggregated trainings and trainings tailored for small household plot farmers as well as those who are more commercially oriented. In other words, trainings need to be customized to cater to the different needs of small household farmers as well as mixed-income and full-time, larger commercial farmers. For example, female producers in the Western Balkans are already managing pest control and water stress in areas where high value crops are being produced and are the main food producers in many farming households. Thus, training and farm field schools need to also be customized to target female producers on greener agricultural water management practices. Second, it is important to build financial or other types of incentive programs for farmers to enhance water conservation and encourage more efficient water use, in addition to undertaking conservation agriculture to improve soil structure, soil fertility, and soil water retention, and to promote the selection of more water-efficient crops (for example, drought-resistant varieties of fruit and vegetable crops). Finally, these types of on-farm interventions can also focus on incentivizing mixed-income and full-time, large commercial farmers to uptake greener food production processes by reducing the use of

chemical fertilizers and pesticides, with the goal of targeting European markets, where there is a growing demand for organic produce.

IMPLEMENTATION AREA 3: INCENTIVIZE FARMER-LED IRRIGATION DEVELOPMENT

Explore and design interventions to introduce farmer-led irrigation development (FLID) initiatives for farmers who rely on private irrigation from groundwater and related sources. As table 3.4 in chapter 3 illustrates, a large majority of farms across the Pannonian Plains, Adriatic Coast, the Hills, and the Isolated Plains are "individual" irrigators; that is, they have access to private irrigation from a borewell or river, or some other source of water. This implies that investment in large-scale public irrigation schemes does not reach these farmers. These farms may not be connected to a surface irrigation source, or if they are connected, they may receive only an unreliable supply; therefore, they turn to other irrigation solutions. This presents an opportunity to explore the potential for FLID in these areas. FLID is defined as a process in which farmers take the lead in improving their water use. They bring in or develop new ideas and technologies, change investment patterns, and create new knowledge—inevitably involving other actors, such as the surrounding community, the government, and the private sector (Izzi et al. 2021). In the context of the Western Balkans, national and subnational public sector agencies can focus on the promotion and establishment of FLID interventions including: (1) creating knowledge campaigns to promote the benefits of irrigation farming and related practices; (2) strengthening nascent irrigation equipment supply chains through better information and higher sales volumes; (3) reduce the price of equipment through tariff reductions, and acquisition costs through matching grants; (4) and conduct policy/legal reviews to set the stage for reforms in irrigation governance, and to facilitate ease of farmer access to FLID processes (Izzi et al. 2021).

To catalyze FLID-type approaches in areas of individual irrigation, it is critical to operationalize support through a set of priority interventions that can be packaged together to make the surrounding environment more conducive to farmers who are taking the initiative to invest in individual irrigation systems. Operations can be funded and implemented either by governments alone, or with the support of development partners (box 5.2 provides an example). Several donors might be involved, and a public sector champion may be identified to lead the process and bring all stakeholders together (Izzi et al. 2021).

In conceptualizing a FLID operation the following ingredients are necessary:

1. A clear **theory of change** should be formulated to provide a schematic of the operational logic;

2. **Eligibility criteria for potential beneficiaries** should be defined, and they should recognize the particular challenges faced by women farmers and other marginalized groups;
3. **Infrastructure**: Appropriate solutions should be selected, and private infrastructure development should be prioritized;
4. **Scale:** Operations should focus on reaching hundreds of thousands of farmers in order to achieve scale;
5. **Stakeholder roles:** It is critical for FLID operations to build alliances between all stakeholders—that is, the public; financial institutions; irrigation equipment suppliers; value chain actors; and farmers themselves--with the important central principle, that farmers are at the center of FLID operations. To ensure that they remain at the center, it is important to ascertain the social factors driving the behaviors and choices of farmers; for instance, whether personal networks and family relationships are exerting an influence on irrigation decisions, and whether these have implications for improving the rate of adoption of various technologies.

   This paper has stated that the uptake of irrigation by farmers after the installation of irrigation infrastructure has proven problematic in some countries of the region, even after intensive periods of consultation and agreement with farmers. More detailed investigation is needed to understand the reasons for this, but it is clear is that even when I&D systems are rehabilitated or modernized, farmers may still face obstacles to using the services. Such obstacles may include the cost of connections; the availability and cost of on-farm irrigation equipment; difficulty in accessing credit and obtaining subsidies; lack of proper access to and prospects in the markets; and above all, better (thus competing) income opportunities off-farm. Many retired or mixed-income farm households have quite rational reasons for staying with low-value crops that are easy to manage and easy to market, rather than switching to relatively risky and demanding high-value crops. Thus, interventions targeted at on-farm agricultural water and crop management need to design incentives to adopt new technology based on more insightful understanding of the social, gender, and farm characteristics of producer communities. This will require focused efforts to understand the dynamics within specific farming systems, taking into consideration the size of the farm systems; sources of income; crop mix, and agroclimatic zone. It will also require explicitly focusing on gender norms in farming communities to obtain the same rigorous detail about both female and male household members. It should also go beyond female-headed households by conducting mixed informal focus group discussions. Incentivizing farmer-led initiatives that have an approach targeted at (or at least including) female farmers can help create investments that are grounded in accurate water accounting data

(from high-pressure, on-demand systems, either private or on-demand larger systems) specifically for and from female producers; and,

6. **Flow of funds**. Along with the government budget for a FLID operation, private stakeholders may also allocate funds. When farmers cannot afford the full cost of infrastructure or equipment that they will own privately, blending their resources with public resources is needed. Various procurement options are available, involving government, financial institutions, equipment suppliers, value chain actors, and farmers. In all cases, **farmers should maintain agency** in the procurement and rollout processes (Izzi et al. 2021) (see box 5.2).

BOX 5.2 Case study: Operation to catalyze FLID in Niger

- The opportunity to support catalyzing the FLID process in Niger came with the Sahel Irrigation Initiative Project (SIIP), a World Bank supported regional framework.
- In Niger, the project focuses on very small-scale irrigation development (less than 1 hectare, up to a few hectares), by individual farmers or by small groups wishing to transition to more commercial crops such as vegetables, and water mobilization (such as improved rainwater harvesting with partial water control) to produce rice, sorghum, and vegetables.
- Innovative technologies such as drip irrigation and solar pumping are being promoted.
- Niger is endowed with ample groundwater resources. The use of solar pumping will allow easier abstraction or lifting of groundwater, reducing labor requirements for many burdened farmers.
- Knowledge of these innovative technologies is shared through multi-stakeholder platforms (MSPs), which are useful for knowledge dissemination and understanding the challenges that farmers face. They also provide opportunities for information sharing and exchange.
- SIIP supports farmers by helping them overcome their financial constraints, and providing subsidies of 95 percent for small community schemes, and 40 percent for private developments.
- Inclusion plays an important role in addressing financial constraints: women and youth are provided with a 100 percent subsidy, and alternative/innovative financing mechanisms to support private irrigation to reduce upfront costs.

Source: Izzi et al. 2021.

Evaluate opportunities for the development of private I&D systems, and where applicable introduce pressurized systems for enhancing on-demand and on-farm irrigation efficiency. Traditional schemes are generally comprised of canal systems with structures for a certain degree of flow control and measurement of the water provided to users. But the service provided to users is typically not flexible, with an untimely supply of water (low reliability), and a low level of WUE. Thus, where applicable, opportunities can be explored to bring in more on-demand pressurized surface or sprinkler/drip irrigation systems and scale the potential of private irrigation using groundwater sources, in a sustainable manner.

IMPLEMENTATION AREA 4: ACTIVATE AND STRENGTHEN AGRICULTURAL KNOWLEDGE SERVICES AND INCLUSIVE ACCESS TO MARKETS AND VALUE CHAINS

In areas where I&D systems are optimized, it is critical to simultaneously invest in linking irrigation services with the development of markets, and inclusive, short-term supply chains for selected commodities, specifically targeting small, household farms. **Constraint #6,** discussed in chapter 2, highlighted issues of weak market integration for many (mainly small) agricultural producers in the Western Balkans, along with weak or nonexistent farm advisory services. It also highlighted the ineffective dissemination of agricultural knowledge that fits the needs of various farm sizes and production profiles. In addition, **Constraint #11,** discussed in chapter 3, indicated that small household farms can rarely access land and credit markets; these farms have little incentive to make irrigation investments to increase their on-farm irrigation development, because they have limited potential to market their produce and connect with off-takers and buyers, or to access finance. This may partially explain why the uptake of irrigation systems by farmers is still problematic in several regions, such as in parts of Croatia and Albania (particularly in Albania), where there is a high percentage of small household farms (farms of less than 1 hectare). Currently, little income from smallholder farming, combined with limited off-farm job opportunities is resulting in outmigration from rural areas, particularly in Albania, Croatia, and Bosnia and Herzegovina; this is partly associated with poor links to markets and a low level of available agro-food processing facilities for some commodities, particularly for fruits and vegetables.

To address these constraints and obstacles, it is recommended that a component focused on increasing marketing opportunities for smallholder farms that are producing irrigated crops be included in future I&D investment projects. This can include interventions such as (1) promoting partnerships with the private sector (thus connecting farmers to off-takers); (2) promoting and scaling existing opportunities for youth in agro-entrepreneurship; (3) improving and enhancing marketing and agricultural input support to these farms, to

increase their opportunities to sell their commodities; and (4) training and coordinating farmers to organize around specific commodities. These types of interventions can benefit farmers by improving smallholder farming income and market potential to ensure that they can afford and pay for improved I&D services. It can also enable small household farms and medium, mixed-income farms to transition from subsistence, low-value agriculture to higher-value crops, thereby supporting the structural transformation toward more productive and more profitable farming. An example of how this has already been achieved in the Western Balkans is presented in box 5.3, which underscores how important training and marketing opportunities for high-value crops are, as an integral part of the (eco)system approach for I&D investment in the region.

BOX 5.3 Integrated agricultural and irrigation development in Zivince (Bosnia and Herzegovina)

The irrigation system of Zivinice is in the municipality of Zivinice (BiH). In 2009, a training center was established, with a farm of 50 hectares to be used to train farmers in irrigation practices and the cultivation of high-value crops like strawberries and cornichons. Farmers were provided with a small plot of about 0.2 hectares where they learned about agricultural and irrigation practices. As a result of the training, a group of farmers formed a cooperative and started to cultivate small areas, mostly in their home gardens. Soon an agroindustry was established in the area to take care of the cooling and marketing of the produce the farmers grew. As no irrigation system was available, most farmers used tap water, but this soon created a problem of water scarcity, and the development was not able to expand. However, the farmers were interested in obtaining irrigation systems that would allow them to increase their cultivated area.

With the Irrigation Development Project, financed by the World Bank, the area was considered high priority, and a new irrigation system was built, consisting of a river diversion dam, a reservoir tank of 500 cubic meters, and a pressurized irrigation network that uses difference in elevation to provide the adequate pressure to the system. The network is equipped with metered hydrants that provide irrigation water to groups of about 15–20 farmers.

The municipality financed the entire cost of the system up to the hydrant and provided an 80 percent grant for the purchase of on-farm irrigation equipment. The farmers were required to contribute to be part of the users' association and to have access

(continued)

BOX 5.3 (continued)

to the irrigation water. The area covered by the system is 150 hectares, but the actual irrigated area is much smaller, since on average each family irrigates only about 0.1 ha. The investment cost was in the range of € 2,000–3,000/hectare.

The association is made of 138 farmers, but around 360 families live in the area. Expansion of the system is planned for the near future to provide water to those families who are interested, but who are at present not served by the system.

The management of the system was outsourced to a private company in cooperation with the farmers (One farmer is nominated to be responsible for opening and closing each hydrant). There are agreements with the farmers concerning the amounts to be paid for the O&M, but fees are low (And since it is a new system, there are relatively low maintenance costs).

Production has concentrated on cornichons: there are four cold stores in the area that also market the produce. This is the largest area in BiH to produce cornichons, and all the produce is sold without any problem.

Farmers get high returns for their investment and their work, since it is estimated that the area produces some 2,000–3,000 t/year of cornichons, and the average price is 0.1 KN/kg. For an average production of 2,500 t/year the income per farmer would be € 3,300/year, most of which will be returned to the family, since cornichon production is highly labor intensive.

The key for the success of this system stems from the following factors:

1. Most of the farmers were already trained in the production of high-value vegetables and irrigation practices.
2. The farmers knew that they could sell all their produce; the limiting factor was the lack of irrigation water.
3. The agro-industries were interested in cooperating with and assisting the farmers because they knew that the potential market was large.
4. The contribution of farmers for 20 percent of the investment was essential to guarantee their effective participation in the development and operation of the system.
5. Strong coaching and support were provided by the municipality.

Note: BiH = Bosnia and Herzegovina.

Integration into the European market brings new market opportunities, but also greater competition; thus, increasing the importance of making the agricultural sector of the Balkan countries more productive and competitive. This may also require investments to strengthen both the upstream and downstream parts of the value chain, especially since European markets demand consistently high standards of quality, safety, and reliability. Improvements in I&D infrastructure, management, maintenance, and operation cannot be viable unless the investments are coupled with interventions to provide farmers with access to digital agricultural tools and decision support systems for marketing, pricing, and access to soil and weather data, to enhance their potential for income from irrigated agriculture.

The importance of women in labor-intensive, high-value irrigated production in the Western Balkans underscores the need for training, marketing support, access to technologies, and value chain links targeted at female producers. This may entail rolling out digital agriculture technologies by WUOs, cooperatives that may already exist, or female producers who can directly benefit from access to improved knowledge of pricing and weather patterns. This will entail women-only trainings and targeted advisory services for female farmers by potential extension agencies (either public or private firms), or a training-of-trainers model through which women farmers train and coach other women. Before carrying out such targeted trainings, women should be interviewed directly so they have a chance to explain the constraints they face in irrigated production. In addition, improved access to high-quality inputs such as seed and fertilizer, especially for women producers in Albania and Kosovo, will be necessary to improve the productivity of high-value irrigated crops. This can also be complemented by increased support to agribusiness enterprises and dealers to improve input supply of certified seeds and high-quality fertilizer. In addition, support to producer associations to strengthen the position of small-scale producers, both male and female, vis-à-vis aggregators and processors when negotiating prices should also be considered.

IMPLEMENTATION AREA 5: INFRASTRUCTURE OPTIONS FOR I&D

As the region has gone through several particularly difficult circumstances, resulting in the total area under effective I&D being lower than it was some 25 years ago, the challenge now is to operate and maintain the systems so that their sustainability is ensured. A one-size-fits-all infrastructure investment strategy does not meet the requirements for enhancing the performance of I&D systems across the Western Balkans. Therefore, a *basket* of options should be considered. For example: (1) modernizing the current systems, which has already taken place with those systems that were more

attractive economically; (2) letting the current systems decay, as several Eastern European countries have done (for example Romania and Bulgaria); (3) maintaining a basic MOM to keep the main infrastructure intact and preserve the option of future rehabilitation and modernization in cases where there is a reasonable possibility that market, technology, or climate developments could render these systems profitable at some point in the future. Such an approach could be more cost-effective than allowing the complete collapse of the current systems and then having to fund the costs of completely new construction; and (4) innovation and repurposing, such as maintaining the drainage and flood management function within an Integrated Water Resources Management perspective and using canal systems to supply water to individual farmers (including opportunities to provide piped irrigation). This will depend on the demand and readiness of farmers, or their cooperatives and investors to organize themselves and shift to new forms of farming. This underscores the need for detailed analysis of the diverse needs of different farm systems, as well as the constraints, incentives, and opportunities for each of them.

To respond to the scope and scale of infrastructure development in all seven countries, an array of infrastructure options is recommended, to apply to different country contexts. It is important to note that these six options are complementary, not mutually exclusive. However, before determining which option or set of options is best suited for an operational investment, it is critical to conduct a social and economic assessment to determine which option would be best to pursue for which farm type and related agroclimatic zone, in each country.

Option 1: Modernization and improved management of poorly performing multiuser irrigation systems

The main objective of this option is to improve the performance of the multiuser irrigation systems that are currently in operation. Approximately 300,000 hectares have been rehabilitated in the Western Balkan region: in most cases there are significant deficiencies in their performance due to:

1. Low uptake and use of the rehabilitated systems, reflected by the gap between equipped area and irrigated area. This gap generally ranges from 28 percent to 50 percent for the countries of this region;
2. Low performance of irrigation management due to many technical and other deficiencies (among them, unreliability of the water distribution service; low levels of maintenance; scarce use of modern database systems or IT technologies; obsolete or insufficient maintenance equipment; transport facilities below needs; and unattractive

remuneration of staff). The causes of these shortcomings are varied but are usually due to technical deficiency of the system, financial limitations, and/or institutional limitations;

3. Financial sustainability of the management institutions is largely dependent on government funding for covering the actual O&M costs since the ISF collected is much below the actual needs for maintaining the system. In some cases, it was found that the fees covered less than 10 percent of the actual costs;
4. Low uptake of modern irrigation methods (sprinklers, drip), and other green agricultural practices, at the farm level. In many cases the benefits arise not so much from water saved, but from higher crop yields due to better placement of water and fertilizers. The combination of these factors is largely responsible for the low level of agricultural productivity of the irrigated lands in many Balkan countries, which is generally below European standards.

Modernization can include technical and managerial upgrading, combined with institutional reforms. Modernization is often associated with the process of transforming an open canal system to a pressurized one; this is an expensive operation, and it is most likely to be worthwhile where much of the command area is used for high-value crops and water is scarce. In such a case, the efficiency gained allows more area to be either irrigated or conserved—this is most relevant in the hotter and drier southern part of the Western Balkans. Other forms of modernization, like improved canal regulation, in-system storage, the remote operation of hydraulic structures including Supervisory Control and Data Acquisition (SCADA) are much less costly, but some of them require staff that are well-trained in their specific use. So far, a high-tech modernization process of irrigation systems has rarely been used in this region, but the adoption of modern on-farm irrigation technologies is being used and promoted in all the countries. These types of modernization investments need to be coupled with improvements in irrigation service delivery and institutional performance, as was described in detail in intervention area 1.

Option 2: Rehabilitation, expansion, and decommissioning of dilapidated multiuser irrigation systems

There are more than 275,000 hectares of irrigation systems that have not yet been rehabilitated, predominantly located in Albania, North Macedonia, and Serbia. This region has considerable experience, with more than 300,000 hectares rehabilitated so far. This process has largely concentrated on the main and secondary canals, while tertiary canals have generally been excluded: therefore, they remain a weak point in the system and need future improvement. Typically, only a minority of large, commercial farmers use these systems, limiting the value that the country gets from its investment in creating the primary

irrigation system. It should be noted that the term “rehabilitation” is also applicable to drainage systems constructed in rainfed areas. There are more than 3.5 million hectares of such systems in the region, mostly in Serbia and Croatia. The average cost of this option is quite moderate (about $700/hectare) since it has focused on the repair and lining of open canal systems. Thus, careful planning is needed to select which schemes to maintain; and to establish a process of systematic asset management aimed at upgrading maintenance, management, and operational capacities.

Expansion consists of installing irrigation or drainage systems where they have never been before. Following the collapse of the Soviet Union, investments in the region have so far concentrated mainly on the rehabilitation of existing irrigation systems; but there is now growing interest in implementing plans that were drawn up in the 1980s but never fulfilled, as well as in developing entirely new systems. The few new systems developed so far have been medium or small; these are mainly pressurized systems; hence they require relatively expensive solutions that are best suited to high-value crops.

Decommissioning refers to withdrawing public support from systems that are no longer profitable and are not expected to become so again. The selection process proposed under decommissioning will provide a way of identifying the irrigation systems that may be excluded from any future development options.

The financial resources needed will largely depend on the areas to be rehabilitated. Considering that those irrigation systems that offered the best possibilities for rehabilitation have already been done, it is unlikely that there will be a high percentage of systems for which rehabilitation is still economically attractive. The experiences in Albania and North Macedonia show that rehabilitation of the main infrastructure, including secondary canals, is often below €700/ha, but considering that the remaining systems will present greater difficulties, an average figure of €1,500/ha would be a reasonable estimate for gravity systems in those countries. This refers to selective rehabilitation of the main bottlenecks, partial realigning, and some new control structures. Furthermore, pressurized systems that need rehabilitation are quite expensive, because a large part of the infrastructure would need to be replaced; therefore, an average figure of €5,000/ha has been estimated and can be applied to work that needs to be done in Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, and Serbia. On the other hand, completion of systems is needed in some northern areas of the Western Balkans where only the main canals have been constructed. These costs should not exceed €4,000–€5,000/ha; this applies mainly to Serbia, where 13,000 hectares need to be completed. Regarding the preservation of future irrigation systems, a minimum of upkeep can be foreseen; so, this figure should be lower than that for normal O&M.

Option 3: Rehabilitation of drainage systems

The performance of drainage systems across the Western Balkans is well below their potential. Croatia reports that nearly half of the covered area is still in need of rehabilitation. Although exact figures are not available for Serbia, it was reported that most of the drainage systems were in bad condition due to shortage of funds: this is prolonging the typical maintenance cycle from 3 to 6 years and resulting in suboptimal performance; as a national average, it is estimated that the drainage systems operate at only about 30 percent capacity. Many of the drainage systems in Serbia and Croatia also need pumping stations to transfer drainage water into the rivers. In Serbia there are more than 210 pumping stations used for this purpose, and in Croatia there are 74, covering 276,000 hectares.

It is important to recognize that I&D operate on two very different principles: and that their water management and design interventions need to reflect these differences. We recognize that the infrastructure for irrigation systems, and drainage systems, follow quite different principles of water resource management: this needs to be recognized when recommending changes in the existing investment approaches, and in their deployment. While traditionally developed irrigation schemes in the region were designed to simply supplement the need for water for crops, today flexibility and versatility are key elements in the design, along with hydromelioration (land drainage) schemes to protect the land from the adverse effects of water (flooding, waterlogging, and erosion), and to evacuate excessive water and salt from agricultural land. These types of schemes are particularly relevant for the lowland plains of the larger rivers in the Western Balkans.

The costs for rehabilitation of drainage systems are relatively low, on the order of €200–€300/hectare (ha). These investments are affordable, particularly if they are spread over a period of several years. Where the drainage systems are linked to pumping stations that need rehabilitation, the cost will increase to about €600/ha. Therefore, an average cost of €450/ha is suggested for countries where there is a prevailing mix of pump and gravity systems (Croatia, Kosovo, and Serbia).

Option 4: Construction of new multiuser irrigation systems

Only a few new I&D systems have been constructed recently, in Albania (under the recently concluded World Bank funded WRIP) Croatia, Bosnia and Herzegovina, Kosovo, and Serbia. These are small and medium-sized systems, with a few larger ones (covering more than 3,000 ha). The trend has been to develop them as pressurized systems in areas where there is potential for commercial farming; they should be oriented toward the production of high-value crops.

There is uncertainty in estimating the amount of area to be developed, since only a few countries (Croatia, Kosovo, and Serbia) have specific plans for the development of the new areas, and even there, in most cases only part of the potential area has been assessed in any detail. In general terms, the number of new systems developed in the region has been small so far, due to the high cost of development. The cost of new systems can vary considerably, particularly if they include pumping stations. A reference range for pressurized systems is €5,000–€8,000/ha, but an average value of €6,500/ha is also acceptable.

Option 5: Modernization and expansion of private irrigation and drainage

Individual irrigation, where one farm is responsible for abstraction all the way through to application, is the dominant system in the region, whether measured by number of farms, irrigated area, or crop output. The data for Croatia, Kosovo, Montenegro, and Serbia indicate that more than 150,000 farms are using this approach (see table 3.2), and the total for the region may exceed a quarter of a million farms, most of them operating without any formal permit. Individual irrigation tends to be institutionally simple and economically profitable, as it is widely used to produce high-value crops that can easily cover the costs of irrigation. However, in some places unlicensed withdrawals are risking overexploitation of scarce water sources. Given that most of these systems are unlicensed, they can also encounter difficulties in getting official support and electricity connections. This can impose a significant constraint on the expansion of such systems, and individual farmers are in a quite disadvantaged position compared to multiuser systems, where all the capital investments are generally covered by the government. However, the benefits of private I&D are flexibility and reliability of year-round service. Much of this type of irrigation is, in fact, happening inside underserved areas of the major irrigation systems, pumping from drains or main canals. Groundwater resources are quite abundant in parts of the Pannonian Plain and the isolated plains, while those along the Adriatic coast are more limited, and are impacted by related environmental problems.

Option 6: Promote investment in storage, flood protection infrastructure, and river works to mitigate the impacts of climate change

It is increasingly recognized that existing I&D infrastructure, if restored and modernized, can be instrumental in reducing the risks arising from climate change in terms of agricultural productivity and sustainability, and land management. Prolonged periods of drought in the future, combined with more frequent and more severe floods will make agriculture more and more vulnerable to climate shocks, and increase the need for various types of storage infrastructure. While irrigation infrastructure can be used to supplement or fully provide

for increased crop water requirements, functional land drainage and flood protection infrastructure and other river works can protect arable land from the harmful impacts associated with climatic risks. Thus, it is important to consider investment in the restoration of flood protection infrastructure and river works to enable better protection and control of floods, and adequate exit of drainage discharge from agricultural land. These things are critical elements in sustainable I&D modernization programs, as are critical flood risk mitigation measures. Before determining the right type of investment, it is important to assess the environmental impacts of flood protection, drainage, river works, and additional storage facilities for drought and water stress periods, and prior to seeking financing. For example, in Bulgaria, in order to meet the criteria for investment support under EU funds and other instruments in the EU Water Blueprint and Green Infrastructure Communication, a strategic environmental assessment that outlines an integral planning process for the country's central, territorial, and local governments, and the National Assembly is required.[6]

There is an important difference between the development of private irrigation by small and medium-sized farms, which are often irrigating less than one hectare, and by the large farms that have mostly developed from previous *agro-kombinats* and now operate as private companies or cooperatives. Apart from the difference in order of magnitude of their water requirements, the first group may have limited financial capacity, and therefore a need for credit facilities and subsidies. The second group has greater financial capacity and may be in a better position to partially or totally finance the required investments. In addition to the development of individual I&D systems, there is a wide scope for modernization of on-farm irrigation systems that are currently supplied by rehabilitated multiuser irrigation systems. This potential is particularly large in countries like Albania and North Macedonia. Lastly, it is important to emphasize that this kind of development is already receiving government support through rural development programs that have access to EU or national funds. Therefore, the aim of this option is to strengthen the present efforts and provide ways to overcome some of the present constraints for both small farms and large, full-time commercial farms.

The cost of developing a well for medium and small farms, including the digging of the well, the pumping set, and the pipes, may be on the order of €1,500/ha; so, if government financed 50 percent of the costs, its contribution would be around €750/ha. Modernization of on-farm irrigation systems can potentially be applied over much of the area currently irrigated by gravity and surface irrigation, but it can only take place if the water delivery is sufficient to meet crop irrigation requirements, as well as the more frequent schedule needed for drip irrigation. In any case, for this type of development the government financing is normally about 50 percent of the total costs, meaning a contribution of €750/ha.

IMPLEMENTATION AREA 6: INVEST IN RIVER-BASIN-TO-FARM SMART IRRIGATION AND CLIMATE SERVICES

Invest in modernizing national and subnational hydrometeorology departments across the Western Balkans. To address **Constraint #3,** described in chapter 2, and to enable national water resources and irrigation agencies to respond to the risks that climate change poses for agriculture, investments to enhance and modernize the national, subnational, local, and irrigation service providers' hydrometeorological and agrometeorological capacities is needed. This entails modernizing the way agencies observe, forecast, model, and disseminate real-time precipitation, evapotranspiration (ET), temperature, wind pressure, humidity, and river flow data services to help irrigation service providers design, plan, adapt, and modernize infrastructure, and allocate water to end users. These measures are critical to enhance the resilience of food producers against changes in ET, temperature, and rainfall. For instance, information on subbasin rainfall variability at multiple scales can complement the existing engineering requirements for optimal performance standards for multiuser irrigation systems (Sinha et al. 2018). Coupling data on hydrological and meteorological patterns at various spatial scales (subbasin, and basin-level hydroclimatic data) with the engineering requirements of irrigation systems can enhance the ability of I&D investments to improve the resilience of agricultural production against climate-related meteorological uncertainty. This additional layer of analysis can augment scheduling for irrigated water delivery within the command area, tailored to farmer cropping and irrigation choices within the river basins of intervention. Although these practices are taking off in many parts of the world, they are yet to be implemented at scale in the Western Balkans.

The World Bank is already investing in advancing and modernizing the capacities of national hydrometeorological agencies in Albania, Kosovo, and Central Asia. Box 5.4 explains how the World Bank-funded Central Asia project presents best-practice learning that can benefit ongoing and future interventions in the Western Balkans.

Invest in monitoring and measurement mechanisms that support joint and collaborative water accounting processes. These processes can inform farmers about changes in rainfall, temperature, and on-farm water-use patterns, and encourage collaborative relationships with water resource and/or irrigation management agencies. Constraints 4, 5, and 10 all raised issues about information gaps that are preventing farmers in the Western Balkans from strengthening the resilience of their irrigated agriculture to current and future climate shocks and stressors. For instance, **Constraint #4** highlighted the fact that irrigation service providers have limited awareness of the water consumption patterns of farmers using different irrigation techniques, as well as under different climate scenarios for various crop

BOX 5.4 Central Asia Hydrometeorology Modernization Project: Enhancing weather, climate, and water information services

In Central Asia, where as much as 30 percent of the workforce relies on farming and livestock for livelihoods, changing weather patterns could slash agricultural production by up to one-third, creating food insecurity. Critical weather, climate, and water information can help agricultural workers grow and protect their crops, reduce disaster risks in locations prone to floods and mudslides, improve operation of hydropower networks, identify at-risk roadways, and anticipate the safest evacuation routes.

Initiated in 2011, the Central Asia Hydrometeorology Modernization Project (CAHMP) is improving the accuracy and timeliness of hydrometeorological services in Central Asian countries and helping them adapt to future climate change risks. The $28 million project is funded by the World Bank and is complemented by more than $2 million in technical assistance grants from the Global Facility for Disaster Reduction and Recovery (GFDRR), focusing on upgrading infrastructure and building capacity. The new technology and capabilities introduced by the project allow scientists to observe, forecast, and deliver water and climate services more sustainably across the region, with a special focus on the Kyrgyz Republic (Kyrgyzhydromet) and Tajikistan (Tajikhydromet).

types; **Constraint #5** pointed out that farmers across the Western Balkans are rarely able to measure (at the on-farm scale) how much water they use (1) from crop to crop; (2) from season to season; and (3) how much water they consume using one method of irrigation (for example, flood) as opposed to another (sprinkler). **Constraint #10** also pointed out that small household farms and mixed-income commercial farms traditionally do not have reliable data on crop and weather patterns, the effectiveness of pesticides, the nutrient composition of fertilizers, the germination rate of seeds, the health status of planting material, or access to price data in nearby markets. These knowledge constraints all dampen the demand for uptake of irrigation services. To address them, investment is needed to provide farmers, both male and female, with direct access to agrometeorological and related climate data, as well as to decision support systems or tools. These resources will enable them to measure and monitor weather patterns, gain access to price information, and learn about their own water and climate footprints. Decision support systems can be facilitated by collaborative data sharing between service providers and farmers through various channels, such as WUOs, female producer groups, municipalities, or via private-sector contracting arrangements (off-takers) directly with farmers.

Enhancing climate resilience in the Western Balkans also entails increasing WP while reducing greenhouse gases (GHGs); this requires the application of sophisticated water accounting tools; information and communication technology (ICT) platforms; and coordination with land parceling information systems (LPISs). Specific tools and investments may include: (1) Rapid Appraisal Procedure (RAP) - Mapping System and Services for Canal Operation Techniques (MASSCOTE), or any other water accounting planning tool—this can also be used to inform the prioritization and sequencing of all of the six implementation areas described in this chapter, to aid decisions about I&D modernization; (2) Management Information System (MIS) and SCADA, to inform real-time operation of the canal system; (3) the use of remote sensing tools to inform on-farm irrigation scheduling by estimating demand for irrigation according to climate and soil moisture conditions; (4) remote sensing to facilitate WUO/farmer-level performance assessment via smart phones, which could also be linked to the canal-level management information system (MIS); and (5) aligning and coordinating the development of climate and irrigation information systems to improve the targeting of investments by using the LPISs that have been developed across the Western Balkans.

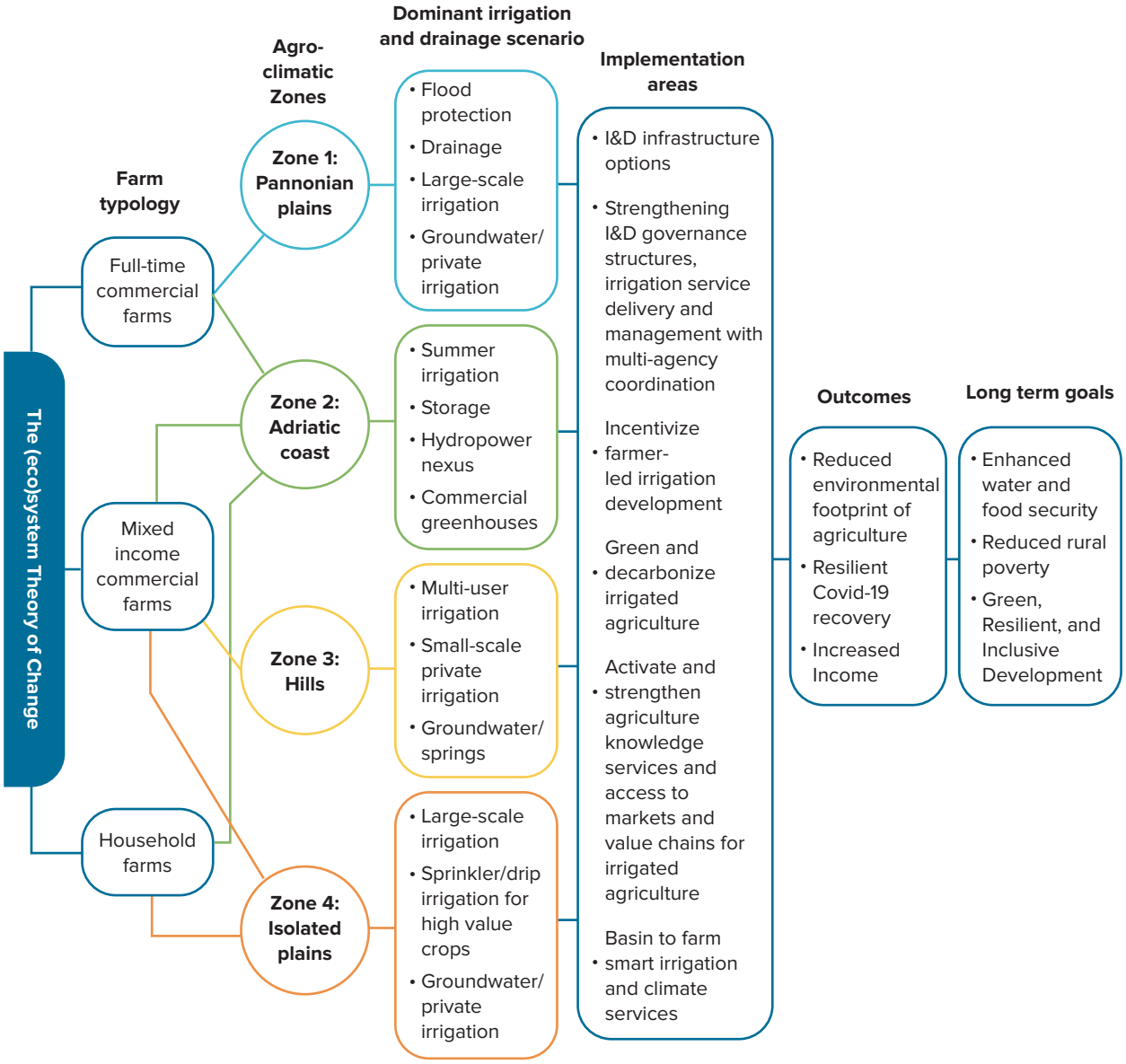
APPLYING THE SIX IMPLEMENTATION AREAS TO FARM SYSTEMS IN THE WESTERN BALKANS

The I&D (eco)system approach provides an opportunity to start a new dialogue with World Bank clients in the Western Balkans, about transformative I&D investments to catalyze inclusive, green, and climate-resilient irrigated agriculture in the region. As a first step stakeholders, both public and private, government and farmer, in each of the Balkan countries, should be mobilized and engaged in multistakeholder dialogues to collectively assess and select the implementation areas that will address the root causes of their challenges, and discuss how to lift the most serious constraints they are facing.

It is important to note that not all the suggested implementation areas are relevant for all seven of the countries, given the diversity in I&D system needs, farming types, geography, and demography, as well as the social, political, and economic priorities. Second, it is of critical importance to determine tangible costs and benefits that may accrue over time. A practical typology of investment options can follow from this, depending on the viability and appetite for a transformative approach to reform within each country. The six implementation areas are summarized graphically in the I&D (eco)system Theory of Change shown in figure 5.3. This chart illustrates the customization of the (eco)system approach to the three different farm typologies, agroclimatic zones, dominant I&D scenarios, and

FIGURE 5.3 The irrigation and drainage (eco)system approach theory of change

Drivers of transition in the Western Balkans



Source: Authors.
Note: I&D = irrigation and drainage.

the applied implementation areas, as well as their intended outcomes and goals. It also highlights the new set of goals to which the I&D sector is now accountable, which can be achieved by means of these intervention areas at multiple scales.

Since not all the implementation areas will be relevant for all farming systems, a customized and sequenced step-by-step design and implementation process is necessary

before applying the (eco)system approach at a country scale. To illustrate how this approach can be applied to the diversity of farming systems, agroclimatic zones, and which of the infrastructure solutions are most relevant for various national and local contexts, table 5.1 presents a summary of all of the potential implementation areas, organized according to the farm typology contexts, agroclimatic zones, and categorized against the specific constraints each of these is addressing; this table summarizes the descriptions that were provided in "Operationalizing the (eco)system approach: Six areas of implementation" section. The high-level menu of potential implementation options that may be relevant for some of the Balkan countries is also classified into recommended time frames for short, medium, or long-term actions. Table 5.1 enables governments to identify which of the available options and opportunities for reforming the I&D sector will best fit their country's situation.

TABLE 5.1 Summary of the I&D ecosystem approach to implementation areas in Balkan farm systems

Dominant farm typology	Dominant irrigation and drainage scenario	Agro–climatic zone	Irrigation and drainage infrastructure solutions
Full-time commercial farms (low value crops, average 6–10 ha in Croatia/ Vojvodina	Flood protection Drainage Large-scale irrigation Ground water/private irrigation	Zone 1: Pannonian plains (Continental Croatia, Serbia/ Vojvodina, northern BiH)	Investment in storage, flood protection infrastructure, and river works Modernization and improved management of poorly-performing multi-user irrigation systems Construction of new multi-user irrigation systems Rehabilitation of drainage systems Modernization and expansion of private irrigation and drainage
Full-time commercial farms (6–30+ ha)	Summer irrigation Storage	Zone 2: Adriatic coast (Adriatic Croatia, Albania, some parts of Montenegro and BiH)	Investment in storage, flood protection infrastructure, and river works Modernization and improved management of poorly-performing multi-user irrigation systems Rehabilitation, completion, preservation and decommissioning of dilapidated multi-user irrigation systems Rehabilitation of drainage systems Modernization and expansion of private irrigation and drainage
Mixed income commercial farms (1–5 ha) 57% of high value crops	Hydropower nexus Commercial greenhouses		

(continued)

TABLE 5.1 Summary of the I&D ecosystem approach to implementation areas in Balkan farm systems *(continued)*

Dominant farm typology	Dominant irrigation and drainage scenario	Agro–climatic zone	Irrigation and drainage infrastructure solutions
Mixed income commercial farms	Small-scale private irrigation Groundwater/ springs Multi-user irrigation	Zone 3: Hills (Central Serbia and parts of BiH)	Modernization and improved management of poorly-performing multi-user irrigation systems Rehabilitation, completion, preservation and decommissioning of dilapidated multi-user irrigation systems Rehabilitation of drainage systems Modernization and expansion of private irrigation and drainage Construction of new multi-user irrigation systems
Household plots (0–1 ha) **Mixed income commercial farms (3 ha Kosovo)** **High-value crops (North Macedonial)**	Large-scale irrigation Sprinkler/drip irrigation for high value crops Groundwater/ private irrigation	Zone 4: Isolated plains (Kosovo and North Macedonia)	Modernization and improved management of poorly performing multi-user irrigation systems Rehabilitation, completion, preservation and decommissioning of dilapidated multi-user irrigation systems Construction of new multi-user irrigation systems Rehabilitation of drainage systems Modernization and expansion of private irrigation and drainage

Source: Authors.

To highlight specific actions to address the policy or regulatory changes needed to support any of the implementation areas highlighted in this report, a complementary matrix of actions for the proposed institutional reforms is shown in table 5.2. Building on the information provided in table 5.1, this table presents additional details to further flesh out the implementation areas of irrigation service delivery, agency coordination, and FLID, and highlights key areas of proposed reform within each of the agroclimatic zones and farm types. These actions are complementary to the implementation areas recommended in table 5.2.

TABLE 5.1 Summary of the I&D ecosystem approach to implementation areas in Balkan farm systems *(continued)*

Dominant farm typology and zone	Priority constraint areas	Green and decarbonize irrigated agriculture	Activate and strengthen agriculture knowledge services and access to markets and value chains	Irrigation service delivery and multi-sector policy coordination	Incentivize farmer-led irrigation development	Basin to farm smart irrigation and climate services
Zone 1: Full-time commercial farms (low value crops, average 6–10 Ha in Croatia/Vojvodina)	**Constraint 1:** lack of coordination **Constraint 4:** limited data **Constraint 7:** weak service delivery; **Constraint 8:** poor I&D infrastructure and MOM	**Medium-term:** Green the existing farm production cycle, enhance soil health, reduce environmental footprint	**Medium-term:** Explore opportunities to target new crop markets for incentivizing new cropping mix for commercial farms	**Long-term:** Enabling policies for farmers to adopt greener practices, green tariff structure **Medium-term:** Accountable irrigation service delivery to meet needs of commercial crop production with new performance indicators, asset management + benchmarking	**Short-term:** Analyze potential for Farmer Led Irrigation Development in areas where private irrigation will be scaled	**Medium-term:** Integrated flood risk management with modernized hydro-met systems **Medium-term:** Improve access to irrigation data for service providers/ farmers using
Zone 2: Full-time commercial farms (6–30+ ha)) Mixed income commercial farms (1–5 ha) 57% of high value crops)	**Constraint 2:** weak environment regulations **Constraint 4:** limited data **Constraint 7:** weak service delivery; **Constraint** 8: poor I&D infrastructure and poor MOM; **Constraint 9:** weak farm advisory	**Medium-term:** Target household farms in Albania (with greener soil, irrigation, and agricultural knowledge, technologies, and inputs access) for enhanced productivity of high-value crops **Short-term:** Scale commercial greenhouses to enable more farms to adopt greenhouse supported farming practices for mixed income farms	**Medium-term:** Strengthen linkages to markets and value chains for household plots and mixed income farms growing high value crops **Long-term:** Strengthen EU market linkages for greenhouse crops	**Medium-term:** Enabling policies for farms to expand 'sustainable' use of greenhouses, precision irrigation technologies **Long-term:** Improve access to credit for household plots		**Short-term:** Enable farmers to access decision support applications for up-to-date weather/ climate data

(continued)

TABLE 5.1 Summary of the I&D ecosystem approach to implementation areas in Balkan farm systems *(continued)*

Dominant farm typology and zone	Priority constraint areas	Green and decarbonize irrigated agriculture	Activate and strengthen agriculture knowledge services and access to markets and value chains	Irrigation service delivery and multi-sector policy coordination	Incentivize farmer-led irrigation development	Basin to farm smart irrigation and climate services
Zone 3: Mixed income commercial farms	**Constraint 2:** weak environment regulations **Constraint 4:** limited data **Constraint 7:** weak service delivery; Constraint 8: poor I&D infrastructure and MOM; **Constraint 9:** weak farm advisory	**Medium-term:** Focus on green water/cropping standards for mixed income farms **Short-term:** Scale-up adoption of precision irrigation technologies in mixed income commercial farms **Medium-term:** Soil health and lowering environmental impacts from agricultural run-off	**Medium-term:** Explore linkages with farmers and technology suppliers/input providers to improve access to markets for private irrigators and mixed income commercial farms	**Long-term:** Strengthen enabling policies for licensing/regulation and support to private irrigators for green farming practices **Long-term:** Regulate water use on private farms where irrigated areas will be expanded **Medium-term:** Enable farms to access investment capital/credit	**Short-term:** Analyse potential for Farmer Led Irrigation Development	**Medium-term:** Improve access to irrigation data for service providers/ farmers for private irrigators using groundwater
Zone 4: Household plots (0–1 Ha) Mixed income commercial farms (3 ha Kosovo) High value crops (North Macedonial)	**Constraint 2:** weak environmental regulations **Constraint** 4: limited data **Constraint 7:** weak service delivery; **Constraint 8:** poor I&D infrastructure and MOM; **Constraint 9:** weak farm advisory	**Medium-term:** Target household plots and mixed income commercial farms with greener soil, irrigation, and agricultural knowledge, technologies, and inputs access for enhanced productivity of high-value crops	**Medium-term:** Strengthen linkages to markets and value chains for household plots and mixed income farms growing high value crops	**Medium-term:** Regulate water use on farms where irrigated areas will be expanded with drip/ sprinklers	**Short-term:** Analyze potential for Farmer Led Irrigation Development	**Short-term:** Enable farmers to access decision support applications for up-to-date weather/ climate data for precision agriculture for high value crops

Note: EU = European Union; I&D = irrigation and drainage; MOM = management, operation, and maintenance; BiH = Bosnia and Herzegovina.

TABLE 5.2 Institutional and policy action matrix for the irrigation and drainage (eco)system approach

Dominant Farm Typology by Zone	Dominant Irrigation Management System	Suggested Irrigation Service Delivery Reforms and Action(s) (common to all zones)	Suggested Irrigation Service Delivery Reforms & Action(s) (specific to zone)
Zone 1: Pannonian Plains (full-time commercial farms with low-value crops; average 6–10 ha in Croatia/Vojvodina)	Water utility companies (majority are public, some are private)	Water pricing policy for irrigation: Assess existing tariff policies or design a new tariff policy that aligns with provisions of the European Commission Directives including cost recovery of water services; adequate incentives for users to use water efficiently; reduction in environmental degradation using a "polluter pays principle" (for example, a two-part tariff area + volumetric fee); (Actor: National regulatory authority or line ministry). Environmental policies: To assess readiness to align with various EU WFD, CAP, and related directives, the designated competent authority to carry out analysis of pressures on water bodies from I&D services; identify what might be blocking a good status; and set mutually agreed upon environmental criteria for concerned irrigation providers. Coordination capacities: Assess the capacity of multiple agencies and develop strategies to establish common regulatory frameworks for the use of European funds to fulfill pre-accession criteria in a coordinated manner across multiple line agencies. Regulatory instruments: Develop policies that encourage cost reduction of service provision by increasing the levels of operational, conveyance, and energy efficiency, based on proven and solid technologies for improved metering, regulation, and control of flows and hydraulic heads.	FLID for private irrigators: Step 1: Conduct a beneficiary diagnostic to define FLID eligibility criteria for male/female farmers (Actors: Donors and national/local agencies). Step 2: Infrastructure assessment, prioritization of private infrastructure development (Actors: Donors, public sector agencies, farmers). Step 3: Assess potential to scale—financial, technical capacity, types of crops grown, etc. for private irrigators (Actors: Donors and public agencies). Step 4: Create a multistakeholder alliance (Actors: public officials, financial institutions, irrigation equipment suppliers, value chain actors, farmers). Step 5: Enable the flow of funds: examine different procurement options to help farmers to afford infrastructure/equipment (Actors: govts, donors, equipment suppliers, value chain actors, farmers).
Zone 2: Adriatic Coast (Full-time commercial farms (6–30+ ha); mixed-income commercial farms (1–5 ha) 57% of high-value crops in Adriatic Croatia, Albania, some parts of Montenegro and BiH)	*Albania and Montenegro* Municipalities, through I&D units, cooperatives, municipal multiutility companies; *Croatia* Water utility companies; *BiH* Municipalities, water utility companies, WUAs, cooperatives.		Legal: Prepare and adopt a WUO act if it is not yet available (Actors: National governments)
Zone 3: Hills (mixed- income commercial farms in Central Serbia and parts of BiH)	Actors: Water utility companies		FLID for private irrigators (Same steps as in Zone 1)
Zone 4: Isolated Plains of Kosovo and North Macedonia (Household plots (0–1 ha); mixed- income commercial farms (3 ha)	*Kosovo* Water utility companies; *North Macedonia* WUAs, water utility companies, water management enterprises		Legal: Prepare and adopt WUO act if it is not yet available (Actor: National government) FLID for private irrigators (same steps as in Zone 1)

Source: Authors.
Note: BiH = Bosnia and Herzegovina; CAP = Common Agricultural Policy; EU = European Union; FLID = farmer-led irrigation development; WFD = Water Framework Directive; WUA = water users associations; WUO = water user organizations.

To conceptualize the application of an I&D (eco)system operation within one of the Balkan countries, box 5.5 presents a brief overview for how the World Bank could potentially support Albania in moving to an (eco)system approach, applying some of the relevant six implementation areas in a new operational engagement.

BOX 5.5 Scoping a multi-scale irrigation and drainage (eco)system operation in Albania—The Albania Water Security, Climate Resilience and Agricultural Competitiveness Project

Building on the ongoing WRIP engagement: A proposed operational engagement in Albania, tentatively titled the Albania Water Security, Climate Resilience and Agricultural Competitiveness Project will be developed as a follow-up of the Water Resources and Irrigation Project (WRIP) and will incorporate lessons from its implementation and other Bank funded projects on environment, disaster risk mitigation, rural infrastructure, and tourism development. The project will also build on the experience of other donor funded programs and the analytical work undertaken by the World Bank on water resources and irrigation management in Albania. The proposed project activities will scale up the cooperation experience with several municipalities and Ministry of Agriculture and Rural Development in the prioritization of interventions at the central, municipal, and farmer-levels. The project will promote a multi-scale, (eco)system approach for the selection of the investments that looks to target interventions to the large number of less than 1 ha household farms that dominate irrigated agriculture in Albania by promoting environmentally sound agricultural productivity in target areas. The project will support the further development of GIS tools for irrigation assets, fees, and management, as well as strengthen the overall hydro-met capacities of the government as well as ensure use and uptake of the water cadaster that was created during the WRIP.

Proposed Project Development Objective: The Project Development Objective is to improve operational performance and quality of service delivery of irrigation and drainage infrastructure, enhance flood risk management capacities, and increase climate resilient agricultural productivity in selected priority agriculturally important municipalities targeting small, household plots. The proposed project will be implemented over 5 years and comprise of interventions across multiple GPs and include these components:

(continued)

BOX 5.4 (continued)

Component 1: Invest in irrigation service delivery & multi-agency coordination—this component will target investments in enhanced service delivery, performance, around new service models and metrics for to improve the capacities municipalities in Albania to have an accountable, customer-centric approach to I&D small, household farms. This component will also invest in national-scale interventions to enhance the inter-agency coordination among water, irrigation, basin, agricultural and hydro-met agencies at a national, river basin, and on-farm management levels. This component will support water permitting and use, including monitoring farm to basin water supply and demand, setting appropriate I&D tariff, and agreeing on-demand water allocation mechanisms to align with areas where pressurized systems will be developed.

Component 2: Incentivize green, environmentally sound farming and agricultural water management practices and adoption of climate resilient crops for small, household farms. This component will focus on investments targeting small, household farms. First it will start by analyzing constraints for small, households in targeted intervention municipalities. Second, it will focus on promoting sustainable methods for on-farm agriculture water management, including giving farmers access to digital solutions for water use monitoring, reducing soil and river pollution from farm inputs, scaling up-take of drip/sprinkler systems, exploring the potential of wastewater reuse in irrigation, solar groundwater pumps, and capacity building and extension services to farmers for promoting ecologically sound farming practices and adoption of climate resilient crops in areas where investments will be made to modernize irrigation schemes. This component will also support investment in crop value chains and increased marketing opportunities for irrigated crops by promoting partnerships with private sector, agro-entrepreneurship, investments in green houses, to allow small, household farms to increase their income base from irrigated agriculture.

Component 3: Enhancing flood risk resilience and the hydrometeorological capacities of Albanian agencies, including GIS mapping that builds on the findings and advancements of the water cadaster report, to enable the government to monitor, measure, and plan for climate shocks in their irrigation planning and in the operation of irrigation systems. All of the rivers in Albania cause periodic flooding; however, the Drin River, together with the Buna, have larger impacts on the arable land, as well as on farmers' homes, businesses, and the infrastructure. This component may also consider constructing, rehabilitating, or reconstructing flood protection embankments in carefully selected priority flood-prone areas.

(continued)

BOX 5.4 (continued)

Component 4: Modernization of the I&D infrastructure. This component may consider including the rehabilitation of tertiary systems in areas where small, household-plot farmers identify major issues of dilapidated tertiary systems, which are preventing water from coming to their farms; and the piloting of pressurized systems for enhancing system and on-farm irrigation efficiency in areas where small farms are using sprinklers, providing them with the opportunity to scale their production and yields through precision irrigation. The project may also consider the rehabilitation and modernization of drainage systems by removing 18 million cubic meters of silt from main drains; 2 million cubic meters from high- water channels; the rehabilitation of 14 pumping stations in the western lowlands; and construction of new drainage pump stations in the peat areas of Maliqi (Korçë) and Torovicë (Lezhë).

Component 5: Project coordination and management will be responsible for project management and the incremental costs associated with it.

NOTES

1. For the purposes of this paper, the term "(eco)system" **does not** refer to the natural ecosystem of living and nonliving organisms; instead, it is a broader term used to describe the socioecological systems that comprise irrigation, that is, a combination of hydrological, environmental, social, economic, governance, and human systems that interact upon and influence the outcomes of irrigation and drainage.

2. Figure 5.1 does not comprehensively cover all of the potential contextual factors associated with irrigation and drainage dynamics in the Western Balkans. But it does illustrate that investments in irrigation are not simply a function of well-functioning or financially sustainable rehabilitated or modernized canals; rather, they are influenced by multiple overlapping systems related to hydroclimatic, farming, governance, agricultural, and behavioral dimensions at diverse spatial scales: individual, farm, district, river basin, sub-national, national, and continental (EU). The figure shows that the relationship between hydroclimatic variability (subbasin scale) and rehabilitated irrigation infrastructure (command area scale) also influence the agroeconomic system (crop yields). Simultaneously, diverse policy instruments (both from the EU, and at the national scale in specific countries) can exert an influence on crop yields and farmer irrigation practices (for example, farmers' decisions about irrigation technology choices can be influenced by state support programs to incentivize adoption), regardless of the degree of rehabilitation of irrigation schemes in the country. Behavioral systems in farming communities can also influence investment outcomes (for example, by influencing farmers' choices about using irrigation technologies, as well as cropping and farm input choices). The complex nature of these interactions indicates that the impacts of rehabilitated or modernized irrigated infrastructure will always (to some extent) be influenced by multiple interrelated hydrological, agricultural, institutional, governance, cultural, and behavioral systems at diverse scales, which must be accounted for in future I&D operations.

3. Irrigation modernization is a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation schemes, combined with institutional reforms, with the objective of improving resource utilization (labor, water, economic, environmental), and water delivery services to farms (Renault 1999).

4. This can include protecting groundwater and surface water bodies against pollution; setting up steps to encourage the active involvement of all interested parties in the implementation of WFD requirements; and related directives specifically related to the I&D sector.

5. Recharge net metering is a strategy where participants infiltrate excess surface water and are rewarded based on the quantity of water infiltrated each year. Infiltration generates rebates on groundwater pumping or other use fees. There are normally no rights to withdraw infiltrated water and benefits accrue to the wider river basin (Kiparsky et al. 2018).

6. See Draft Common Strategy for Management and Development of Hydromelioration and Protection Against Harmful Effects of Water, 2015.

6

The Road Ahead: A Call to Action

This report has responded to the need to fundamentally rethink the approach to the irrigation and drainage (I&D) sector to enable the countries in the Western Balkans to respond to the effects of climate change; to enable the successful structural transformation of the agricultural sector in the region; and to make the critical transitions needed for European Union (EU) accession in a more green and more resilient manner. Regardless of which of the intervention areas underpinning the I&D (eco)system approach will be applied to each country, it is critical that the sector achieves positive impacts along a variety of dimensions, including environmental stewardship, climate resilience, and gender transformation, through socially inclusive and viable interventions. In addition, the irrigation sector needs to meet the objectives of providing enhanced water, food, and economic security for a broader diversity of food producers. As such, the objective of green and environmentally sustainable agricultural growth is no longer an *option* but a necessity for nearly all of the Balkan countries. If approached in a holistic manner, the conceptual investment framework of the I&D (eco)system can play a major role in catalyzing this transformation.

Thus far, a multiscale and multisector coordinated investment approach across the I&D and agricultural sectors has been missing in the Western Balkans. There have been limited attempts to plan I&D infrastructure investments in a manner that cuts across multiple sectors and scales; that addresses the inherent disruptions to irrigation outcomes from diverse systemic factors; and that recognizes the trade-offs and synergies across the sectors. For irrigation investments to truly live up to their potential of catalyzing meaningful structural transformation, they must focus on the potential synergies between the canal and the farm and manage the negative externalities that are inevitable with any technological change introduced into a complex farming system. However, established actors in the sector may resist calls to transition toward a more integrated (eco)system approach;

this may increase the timelines associated with project identification, assessment, preparation, and implementation, and may require deeper legal, regulatory, and institutional reforms. This would also require deeper, longer, and better engagement with core beneficiaries and farmers to be able to better target I&D solutions for farmers' needs. These types of reforms require a longer-term vision, since not all the issues can be addressed in the short term; they require fostering champions who will endorse and embrace such approaches at ***all*** levels of government, beyond the senior leadership.

To incentivize clients to consider introducing I&D (eco)system-style operations—where farm system needs are central, and they drive I&D solutions—investments in field-level leadership (FLL) can be embedded into future operations. FLL is an operational approach that seeks to build on the intrinsic motivation of public sector staff; it is currently being piloted by the World Bank to support organizational culture change in public agencies (Pahuja 2021). Instead of focusing on senior leadership, FLL aims to develop broad-based, decentralized leadership that engages the entire institution. It is based on the premises that champions of organizational change may be in the minority, but they are not rare; that they exist at all levels of the organizational hierarchy; that they can be systematically identified; and that their potential can be reliably tapped to drive positive change. FLL is implemented through a peer-to-peer learning model, in which a public agency that has successfully implemented an FLL program provides the initial training and implementation support for an agency that is seeking to do the same. By relying on internal, peer-to-peer dynamics of behavior change, FLL offers a more cost-effective and more sustainable model for motivating staff than trainings by external coaches and facilitators. It also makes the process of culture change more organic and self-driven, and less vulnerable to changes in the top leadership or external funding. Finally, FLL taps into the knowledge and creativity of the field-level staff, and thus encourages ingenious solutions that are appropriate for specific local contexts. **There will quite naturally be initial resistance to the changes proposed by the (eco)system approach; since the investment framework relies on client governments understanding farm-system needs before prioritizing their investments, running a series of FLL-style workshops as an introductory step may be beneficial in creating a positive, enabling policy environment that will embrace a transformational approach.**

To operationalize the (eco)system approach there is also a need to rethink irrigation service delivery performance metrics. This approach calls on clients and the World Bank to first reconsider the approach to investments in the I&D sector. It also requires a new set of performance indicators and metrics for monitoring and measuring performance that shifts away from the traditional performance parameters. This shift is required to drive the results in current investment projects toward a common vision of enhanced climate resilience,

successful integration into the EU, environmental sustainability, and gender-inclusive growth for the Western Balkans. Specific examples of some of the indicators that can be considered are highlighted in chapter 5.

The irrigation and agriculture sectors are already evolving in various pockets of the Western Balkans, with some countries growing out of the Participatory Irrigation Management (PIM) approach and attempting innovative institutional delivery models. For example, some municipalities are delivering irrigation services at the tertiary scale in Albania and shifting away from reliance on WUAs. There is also a growing trend toward decentralization of the governance systems for I&D, and a rise in the role of the private sector, as well as a growing vibrant entrepreneurial sector that is poised to take off across several of these countries. We hope with this report to have provoked discussions on the shift that is already taking place. We also hope that we have offered new ideas about what this transformation may look like soon.

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