

ACHIEVING WATER STEWARDSHIP IN COTTON IN THE BÜYÜK MENDERES BASIN

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1. Introduction

Büyük Menderes Basin, in south-west Turkey is an important hub for cotton production with 14% of national cotton in Aydın¹ and cotton farming in Söke region (located in Aydın), is the dominant agricultural production with a percentage of 98% of the total agricultural area² and cotton production in Söke has high water consumption due to conventional farming applications³ and cotton farmers are facing water scarcity risks.⁴ The flood irrigation in Söke also results in low crop water efficiency, leads to water losses from evaporation and transpiration, surface run-off, root zone salinization, percolation of dispersing inorganic fertilizers and pesticides as well. Cotton farming in Söke has also negative impacts on the neighboring key biodiversity areas (KBAs), namely Bafa Lake and the Buyuk Menderes delta; hydrological interventions to maintain irrigation and changes in land use patterns due to the increase of cotton farmlands have impacts both on water quality and on biodiversity in these wetlands.

Water footprint of agricultural production constitutes 89% of the total water footprint of production in Turkey and crop production has a share of 92% of the agricultural water footprint⁵. Conventional methods such as flood irrigation is mostly used in agricultural irrigation in Turkey and use of modern methods such as drip irrigation or sprinkler, which uses the water resources efficiently, is limited.⁶ Although the Turkish Ministry of Agriculture and Forestry has incentives program to support farmers to invest in modern irrigation methods, cotton farmers in Söke region do not invest in modern irrigation especially due to the fact that they have to invest in high-tech filtration systems - as suspended solids in irrigation water block the pressurized irrigation pipes, and high investment costs to such infrastructure is a major barrier in front of wider use of modern

¹ Erbaş, 2018

² Efeler Chamber of Agriculture, 2020

³ State Hydraulic Works, 2020

⁴ Söke Plain Irrigation Association, 2019

⁵ WWF-Turkey, 2014a

⁶ WWF-Turkey, 2014b

irrigation in Söke.⁷ As a result, efforts of the local public authorities, chambers of agriculture and irrigation associations that aim sustainable water use in cotton production are challenged.

WWF-Turkey has been implementing Water Stewardship approach for cotton sector in Büyük Menderes basin since 2017. The Water Stewardship approach, which was developed by WWF in 2008, aims to bring together the water-related stakeholders consisting of public, private, and civil institutions in terms of collaborating for better water management. Water Stewardship has a set of steps including reduction of water-related impacts by improvements in water use, and collective action of stakeholders to influence governance and policies⁸ to secure water for business, freshwater ecosystems and communities.

WWF-Turkey facilitated the process to form a multi-stakeholder platform to promote the use of modern irrigation systems in the Söke region and the process resulted in establishment of the Söke Cotton Water Stewardship Steering Committee, which is a public, private and non-governmental organizations partnership.

This paper aims to showcase how Water Stewardship approach addresses the challenges around efficient water use in cotton farming and to mitigate the impacts of cotton production on the key biodiversity areas in Büyük Menderes basin. This work supports the achievement of SDG 6, 2 (in particular SDG 2.4 – Sustainable Agriculture) and 17. The work also presents the steps taken and the results of multi-stakeholder approach during the realization of this work.

2. Büyük Menderes Basin

The Büyük Menderes basin, located in south-western part of Turkey, is the 7th most populated basin in Turkey⁹. Environmentally, Büyük Menderes is not only important for Turkey but also plays a role on the international stage with its three internationally important wetlands (namely Bafa Lake, Isikli Lake and B. Menderes Delta) and ten legally protected areas¹⁰ (Figure 1). The protected areas distributed throughout the basin include mountainous regions, lakes, rivers and the marine area where the river reaches the sea. Its location and diversity create habitats for a variety of species including 4.500 breeding pairs of Dalmatian pelican (categorized as Vulnerable (VU) according to the IUCN criteria), the European eel (Critically Endangered (CR), and the Eurasian otter (Near Threatened (NT))^{11,12}.

⁷ Söke Chamber of Agriculture, 2019

⁸ WWF, 2013

⁹ Ministry of Environment and Urbanization, 2015

¹⁰ WWF-Turkey, 2013

¹¹ National Parks of Turkey, 2017

¹² GoTurkey, 2018

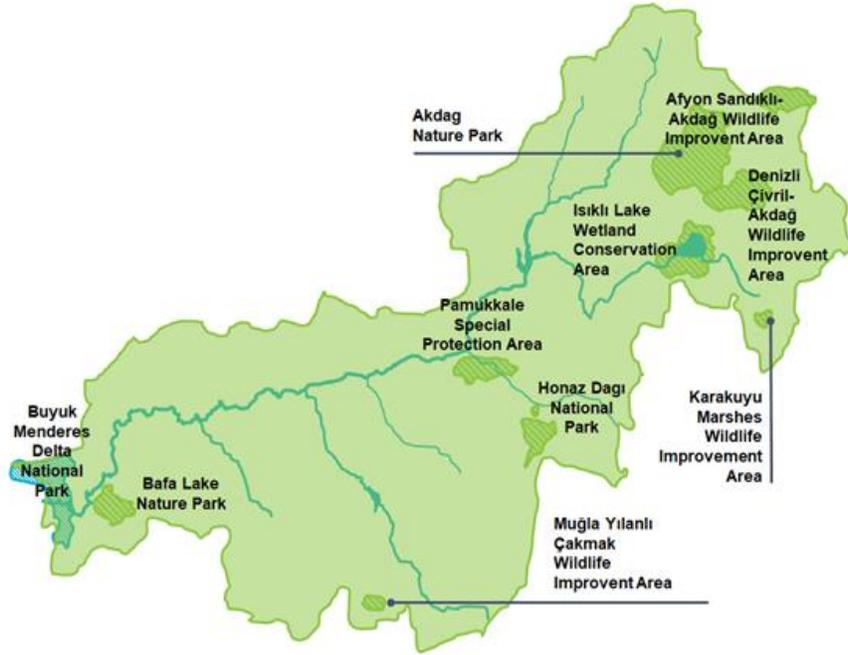


Figure 1. Protected areas in Büyük Menderes basin

Aydın, Denizli and Uşak are the three urban centers of Büyük Menderes and they hold a population of 300k, 560k and 500k respectively, making up the majority of the basin's whole population of 2.5 million inhabitants¹³. The basin has a high socio-economic value for Turkey with industrial and agricultural sectors it holds. The textile and leather industries are the leading industrial sectors especially in the upper basin, near Denizli and Uşak. Agriculture (including cotton production) is comparatively dominant in Aydın (14% of all national cotton production comes from Aydın¹⁴), which is located further downstream. With its natural beauty and rich wildlife as well as a number of historical cities and archeological ruins it contains, Büyük Menderes is an attractive tourist destination and tourism is another important sector for the basin.

2.1 Cotton Production in Büyük Menderes Basin

Cotton cultivation areas in Aydın, İzmir and Manisa provinces together cover approximately 80-85% of whole cotton farming areas in the Aegean Region. Amongst these provinces, Aydın, which is located in Büyük Menderes basin, is the major cotton producer; Aydın ranks first within the Aegean Region in terms of cultivation area size and production amount and second in Turkey by accounting for 14% of total national cotton production¹⁵. In Aydın, 45% of the total surface area (811,000 hectares) is agricultural lands and consists of 366,608 hectares. Other than cotton, olive, figs and chestnuts production has high economic value added in the province.¹⁶ The most intense cotton farming practices in Aydın occur in Söke, Koçarlı and Germencik regions

¹³ Ministry of Environment and Urbanization, 2015

¹⁴ WWF-Turkey, 2013

¹⁵ Erbaş, 2018

¹⁶ Aydın Commodity Exchange, 2018

and Söke holds the highest cotton production rate in Aydın¹⁷. Cotton farming is an important source of income for the Aydın; it serves a source of livelihood for over 30,000 farmer families.¹⁸

In Aydın, there are 10 irrigation associations and 25 irrigation cooperatives currently operating to supply water for irrigation. In the Söke region, as water quantity does not meet the demand, cotton farmers also use water from the Büyük Menderes River and from the drainage channels for irrigation.

During the water allocation planning process, the State Hydraulic Works assessed the water allocation for cotton production in Söke based on the assumption that cotton production will be 60% of the overall agricultural production and land use. However, cotton production and land use in Söke exceeded this limit and has increased to 98%¹⁹.

Despite cotton plant is moderately resistant to drought and salt stress, in most cotton fields in Söke flood irrigation methods are applied (85-95%) and deep leakages, surface runoffs, and evaporation losses are high²⁰. It is estimated that 2.2 billion m³ of water is used to produce cotton per year in Söke²¹.

On the other hand, according to the regional Falkenmark indicators, Büyük Menderes Basin is facing water stress with 1.7 billion m³/year usable water potential and with 1,262.54 m³ water per person/year²². In addition, groundwater and surface water availability in the river basin are sensitive to increasing population and climate change; the National Climate Change Action Plan (2011 - 2023) indicates a 50% reduction in the surface waters towards the end of the 21st century in Büyük Menderes basin, which would lead to severe water shortages in agriculture, settlement areas and industry²³ and this may result in decrease in cotton production in the upcoming terms.

After the severe agricultural drought occurred in Turkey in 2007, the Turkish Ministry of Agriculture and Forestry has initiated an incentives program providing zero-interest loans to the farmers to invest in pressurized irrigation systems and is subsidizing 50% of the total investment costs. However, cotton farmers in Söke do lack the motivation to use the incentives and invest in modern irrigation due to a variety of reasons. Firstly, water pricing in agriculture in Turkey is not based on consumption of water in cubic meters; is based on per hectares of irrigation and water price is moderately low. This challenges the government in promoting water efficiency in agriculture in any region in Turkey likewise Söke region. Secondly, particularly for the Söke region, cotton farmers have to improve their infrastructure by installation of high-tech filtration to deliver clean water to the farmlands as suspended solids in the water resources block the pressurized

¹⁷ Efeler Chamber of Agriculture, 2020

¹⁸ Enderoğlu, 2005

¹⁹ State Hydraulic Works, 2020

²⁰ ICAC, 2011

²¹ Söke Plain Irrigation Association, 2019

²² Hakyemez, 2019

²³ Ministry of Environment and Urbanization, 2011

irrigation pipes. This increases the initial investment costs for farmers.²⁴

The cotton farming in Söke, which takes place around two key biodiversity areas (KBAs) namely Bafa Lake and Büyük Menderes Delta, have negative impacts on these freshwater ecosystems (Figure 2).



Figure 2. Location of Söke Plain and Bafa Lake and Büyük Menderes Delta

Hydrological interventions for irrigation purposes and for flood prevention altered the surface water input from the Büyük Menderes River to Bafa Lake, which increased salinity in the lake over the years, and had several ecological impacts on freshwater biodiversity including decline in the population of the Critically Endangered (CR) European eel (*Anguilla anguilla*) and collapse of the freshwater turtle and crab communities by 1987²⁵.

Intensification of agriculture (mainly cotton) around Bafa Lake along with the discharges of industry and urban wastewaters from the upper basin has resulted in decline in the water quality^{26,27} and nitrogen ammonia was identified at highest ratio in the Bafa Lake during the water quality monitoring study²⁸.

In Büyük Menderes Delta, the natural saltmarsh habitats have been converted to cotton fields and cotton farming is especially intense towards the margins of the naturally inundated areas. Construction of drainage channels for irrigation in and around the Delta, degraded the habitat in the southern promontory.

²⁴ Söke Chamber of Agriculture, 2019

²⁵ Altınsaçlı, 2014

²⁶ Esbash et al., 2009

²⁷ Sasi et al., 2017

²⁸ WWF- Turkey, 2013

2.2 Water Stewardship Approach

The concept of water stewardship serves to unite a wide set of stakeholders interested in water management. In common usage, it often refers to business action on water challenges. WWF's Water Stewardship ladder (Figure 2) defines a set of steps from increased knowledge of water users, improved water use, reduction in the water-related impacts of internal and value chain operations, to steps outside the fences, such as collective action and influence governance. The ladder is a commitment to the sustainable management of shared water resources in the public interest through collective action with other businesses, governments, NGOs and communities. The steps don't need to be implemented in the order presented, but all the steps are part of a continuous cycle, in an on-going process, and should be revisited periodically.

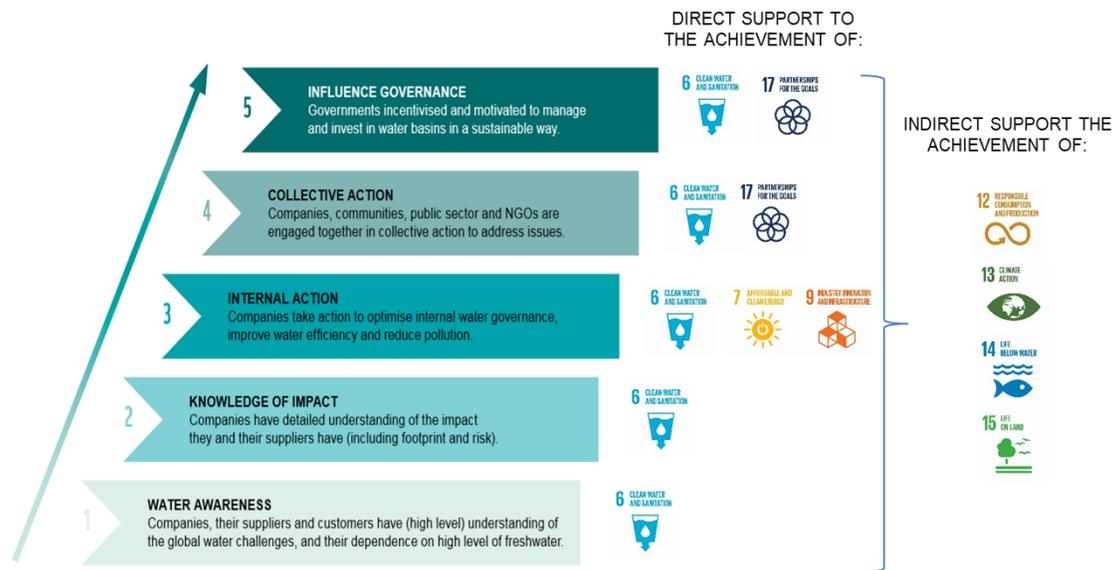


Figure 3. The WWF Water Stewardship Ladder²⁹

3. WWF-Turkey's Water Stewardship Implementation in Büyük Menderes Basin

Water governance in Büyük Menderes is fragmented as well as in other basins in Turkey due to the multi-headed structuring of water management; different public authorities are responsible for water protection and use, and this remains as a barrier in front of effective participation of private sector and civil society to the planning and implementation processes in water management³⁰. As a result of complex structuring of water management, singular efforts of public, private and civil society stakeholders are not sufficient to address the challenges both in water management in agriculture and in protecting the health of freshwater habitats.

WWF-Turkey considers that a multi-disciplinary, multi-stakeholder, inclusive and integrated approach is essential to address water risks for agriculture, freshwater

²⁹ Ortigara et al., 2019

³⁰ WWF-Turkey, 2014b

ecosystems and communities. Therefore, WWF-Turkey facilitated the process for establishment of a multi-stakeholder platform (MSP) in Söke region to eliminate the technical, administrative and financial barriers in front of sustainable use of water resources in cotton farming.

WWF-Turkey has taken below steps (Table 1) as part of its Water Stewardship approach for cotton in Söke:

Table 1. WWF-Turkey’s Water Stewardship steps for cotton in Büyük Menderes

Preparation Phase 2017-2018	WWF-Turkey developed internal capacity on Better Cotton Initiative (BCI) and established a team	WWF-Turkey became “Better Cotton Initiative (BCI) Implementing Partner”
Implementation Phase 2018-2019	WWF-Turkey trained 1,405 farmers and 373 farmers were BCI licensed (corresponding to 8,100 ha of cotton land).	Addressing WWF Water Stewardship Steps: 1 (water awareness); 2 (knowledge of impact); and 3 (internal action)
2018-2019	WWF-Turkey trained 1,191 farmers and 525 of them were BCI licensed (corresponding to 14,281 ha of cotton land).	
2019-2020	WWF-Turkey facilitation for establishing a Multi-Stakeholder Platform (MSP) for Cotton in Söke Region	Addressing WWF Water Stewardship Steps: 4 (collective action); and 5 (influencing water governance)

WWF-Turkey’s facilitation of multi-stakeholder platform establishment includes:

- 1) **Stakeholder meetings** with around 30 institutions (public authorities (the Ministry of Agriculture), municipality, universities, regional development agency, chambers of agriculture, irrigation associations, agriculture cooperatives, national cotton council, The Good Cotton Practices Association (Strategic partner of BCI), and private sector including cotton corporations, irrigation systems supplier companies and textile brands.
- 2) **Identification of key stakeholders and areas of collaboration** to improve water management in cotton production in the Söke region.
- 3) **Discussion platform** in Aydın with the participation of key stakeholders to:

- i) Share the outcomes of the stakeholder meetings including political, technical and financial strengths and barriers around better water management in cotton farming in the Söke region,
- ii) Introduce Water Stewardship approach,
- iii) Discuss the potential mechanisms to initiate collective action of multi-stakeholders to enhance better water management in cotton production in Söke.

4) Secretariat role of the multi-stakeholder platform: During the discussion panel, participants decided to establish the Söke Cotton Water Stewardship Steering Committee and WWF-Turkey has been facilitating the coordination since then.

4. Results and Discussions

4.1 The Söke Cotton Water Stewardship Steering Committee:

The Söke Cotton Water Stewardship Steering Committee is a platform of public, private sector and civil society (Figure 4).

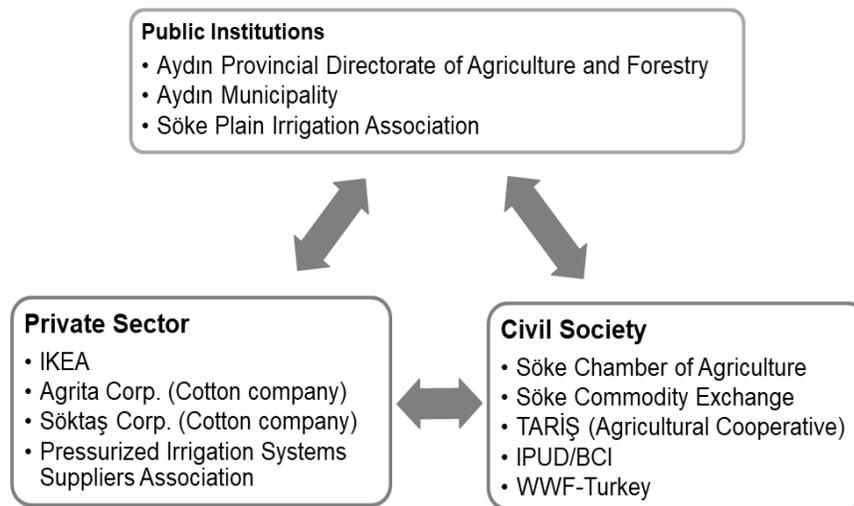


Figure 4. Members of the Söke Cotton Water Stewardship Steering Committee

4.2 Söke Cotton Water Stewardship Process

The Söke Cotton Water Stewardship Steering Committee has taken below steps since its foundation by facilitation of WWF-Turkey:

- 1 Setting Common Goals** The Committee members mutually identified their goal as **“Demonstrating a modern irrigation model in the Söke region as an exemplary to Turkey in cotton production”**

The model aims at developing technical and financial mechanisms that enable efficient use of water, improve water and soil quality, reduce the use of chemical inputs such as fertilizers and pesticides, and to increase the

farmers' income through the production of high-quality and sustainable cotton.

- 2 Defining Activities and Timeline**

The Committee has identified their activities and set timelines for:

 1. Implementation of a modern irrigation pilot project in Söke province in a multi-stakeholder approach,
 2. Monitoring and evaluation of the outcomes of the pilot implementation,
 3. Disseminating the benefits of multi-stakeholder approach and the outcomes of the pilot implementation to other cotton-producing areas in the Büyük Menderes basin and to other areas in Turkey where cotton production is dense.

- 3 Identification of criteria for selection of the pilot site**

The Committee members identified criteria for the selection of the pilot site and gave priority to areas where there is public land near the farms to install the pumping station and the solar energy facility. This aimed to disregard negotiations with farmers for use of their farmland for infrastructure.

The irrigation association, which is a Committee member and is a public authority, committed to provide the public land.

The Committee also prioritized selection of farms where benefits of modern irrigation are demonstrated in the short term.

- 4 Identification of Target Achievements**

The Committee has identified the target achievements by demonstrating the modern pilot irrigation as:

 - Efficient use of water resources,
 - Improvement of soil and water quality,
 - Reduction of the use of chemical inputs (fertilizers and pesticides),
 - Increase in yield and quality in cotton production,
 - Decrease in the input costs and increase in the income

- 5 Feasibility Study and Selection of the Pilot Site**

A technical working group was formed (namely Provincial Directorate of Agriculture, Söke Plain Irrigation Association, Pressurized Irrigation Systems Association) conduct a feasibility study to select the pilot site.

The pilot project covers 37 plots of 17 farmers in an area of approximately 95 ha in Söke (Figure 5).

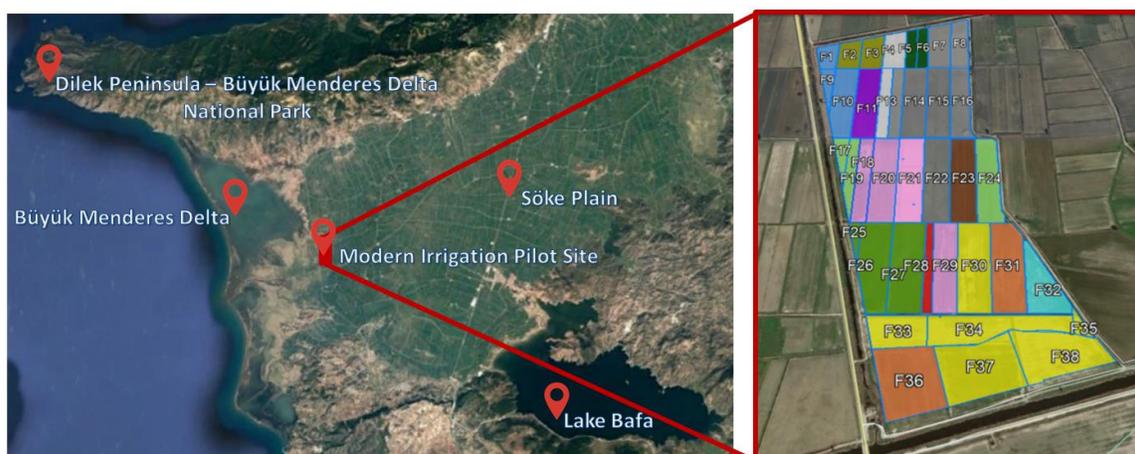


Figure 5. Map of pilot project area to implement modern irrigation in Söke

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| 6 | Meetings with Farmers | Committee identified their members to launch the pilot to the farmers who have cotton lands within the pilot site. The farmers were informed on the project including its benefits such as savings on input costs, soil enhancement, increase in yield and their feedback were integrated into the project design. |
| 7 | Project Proposal Development | <p>The Committee developed the project proposal including:</p> <ul style="list-style-type: none"> - The rationale, - Targeted achievements, - Irrigation and infrastructure plan (including mobile applications, solar power facility, common filtering station, central automation), - Monitoring and evaluation (M&E) program - Budget (an approximate budget of US\$ 460,000) |
| 8 | Assessment of Expected Outcomes | The technical working group has assessed that by the implementation of the pilot there will be a 50% reduction in irrigation water use, approximately 20% saving for input costs, and a 10 kg increase in yield per ha is expected compared to the current irrigation methods. |

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|---|---|
| 9 Roles and Responsibilities | The Committee identified the roles and responsibilities during the pilot implementation: <ul style="list-style-type: none"> - Project Implementer: Aydın Provincial Directorate of Agriculture (is also responsible for budget management and reporting) - Data collection & analysis, infrastructure improvement and maintenance: Söke Plain Irrigation Association - System installation: Pressurized Irrigation Systems Suppliers Association - Capacity development of farmers: WWF-Turkey and the Good Cotton Practices Association - Dissemination: All members |
| 10 Monitoring & Evaluation Program Development | The Committee identified the scope, the parameters and data to be collected for the monitoring and evaluation (M&E) program to evaluate the impact achievements of the pilot based. |
| 11 Financial Support | The Committee submitted the project to the Ministry of Agriculture to receive financial support for the pilot. |
| 12 Risk Management | The pilot project does not coincide with the Ministry's current incentives support program and there are not any other programs of the Ministry supporting collective schemes for modern irrigation. If needed, the Committee is planning to lobby at the decision-makers level on the importance of the project's demonstration for cotton production in Söke. |

5. Conclusions

It is very well known that water is a shared resource and in the lack of availability it is highly expected that today's communities sharing it, will be potential competitors tomorrow. In order not to create a base for this competition, it is necessary to collaborate and find solutions from today.

The water requirement increases steadily and the agricultural sector is the major consumer of water in Turkey with about 34 billion m³/year while the water volume to be utilized by this sector is expected to 72 billion m³/year by 2023³¹. The priority of water for the sustenance of life on earth implies the need to think of management alternatives that transcend these environmental problems caused as a result of its administration³².

In today's world, water management is a very complex issue and it requires a systematic and integrated approach. Water stewardship, which provides means to achieve an integrated approach by enhancing private sector participation to water governance, is a

³¹ Yuksel, 2015

³² Vásquez, 2017

long-term process that starts with raising awareness both on an individual and institutional level and fostering a better understanding of water risks. Meeting sectoral, individual and ecosystem needs altogether is very strenuous and requires long term commitments.

WWF-Turkey's long term goal is to achieve a common understanding by stakeholders on water risks, the importance of freshwater habitats & biodiversity to inspire a water governance model in the basins addresses mitigation of water risks for businesses, ecosystems, and communities in Büyük Menderes.

Individual efforts of public and civil society parties to achieve sustainability in cotton production in the Büyük Menderes basin have been challenged by the fragmented structure in management of water resources and inadequacy of policy and programs that enhance sustainable water use. Establishing multi-stakeholder platforms have proven to be a necessity to overcome such bottlenecks. With this innovative approach, stakeholders have joined their forces by bringing their expertise and best cases into the process and by sharing roles and responsibilities in the form of a Water Stewardship Committee. The Committee is about to gain a legal existence and create a strategy document to share with decision makers. Next step is to bring investments to the area in order to lower the share of farmers and inspire them to take action without hesitating.

These efforts will reveal that the transition to drip irrigation is also possible in areas where the water quality is low and consequently there are problems such as clogging of the drippers. In this way, it will set an example to expand the transition to drip irrigation in other cotton producing regions that have the same problem. The modern irrigation pilot project implementation is first of its kind for Turkey by demonstrating a public-private and civil society partnership.

Via achieving the water stewardship in cotton production, the capacity of cotton farmers will be increased to improve water use and implement better water management practices. This approach also aims at influencing regional and national policy & programs to provide technical and financial support to agriculture for sustainable water management by collective action, supporting the achievement of SDG 6 (Water and Sanitation), SDG 2 (Zero Hunger) in particular SDG 2.4 (Sustainable Agriculture), SDG 17 (Partnerships for the Goals).

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