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Accounting for energy in water resources planning: WEFE Nexus, water allocation and irrigation efficient technologies

Integrated Rural Development Project / TRIGGER

Green Diplomacy Week – a global just energy transition

October 25th, 2023

GFA CONSULTING GROUP

HELVETAS TAJIKISTAN

Background

Project name: Integrated Rural Development Project / TRIGGER

Implementation period: January 2021 - December 2024

Budget: 29 500 000 EUR

Funder: European Union and BMZ

Key state partners: Ministry of Energy and Water Resources, Ministry of Agriculture, Committee for Environmental Protection, Ministry of Economic Development and Trade

Area: Zarafshon river basin and national level

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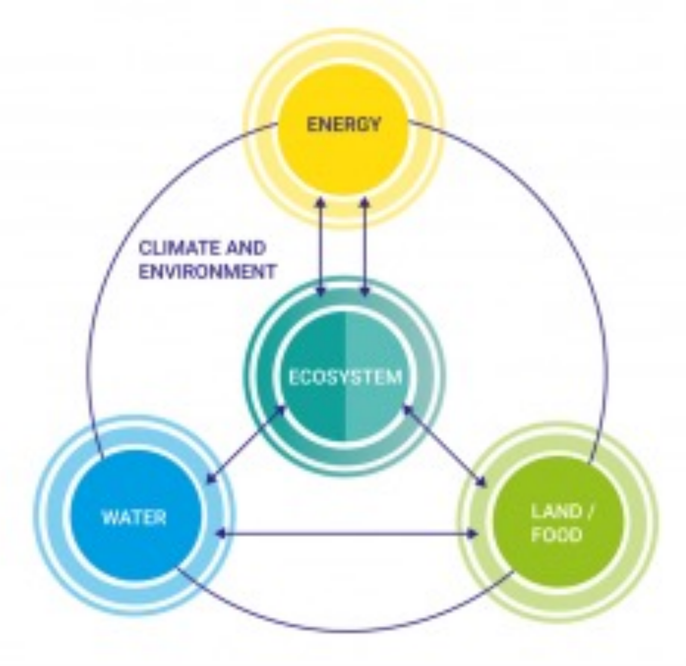
Water-Energy-Food-Environment Nexus



Decisions in different sectors of development are often taken without considering the impact they may have on water quantity and quality, and on other sectors

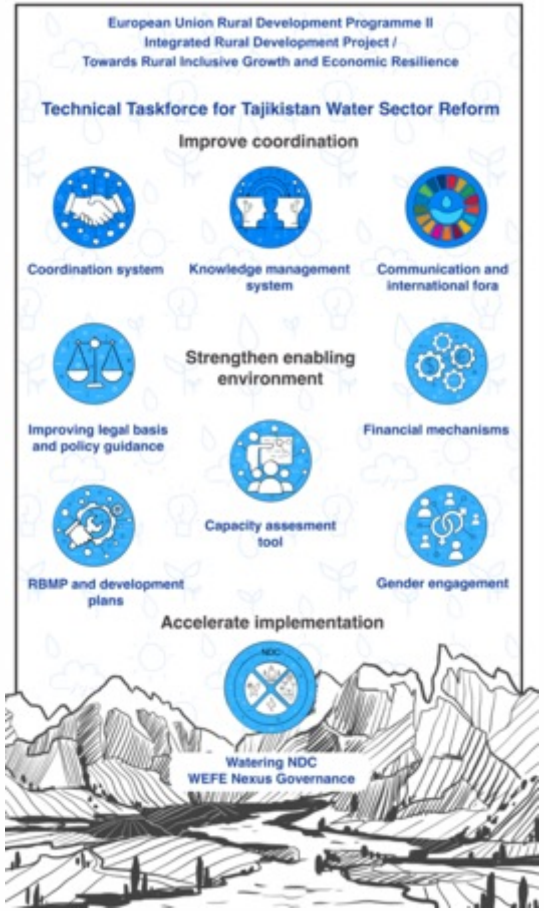
Transboundary Nexus Assessment (TBNA) Methodology (UNECE) and The Water-Energy-Food Nexus (Source: UN-Water, 2013)

UN 2023 Water Conference – Adopting the WEFE Nexus for a water-wise energy transition

COP27 – Nexus solutions for climate-resilient water, energy, food and environment security

Provided technical support to the Ministry of Energy and Water Resources, who is leading discussions on WEFE Nexus at international level

Technical Taskforce for Tajikistan Water Sector Reform



Technical Taskforce for Tajikistan Water Sector Reform

Transboundary Nexus Assessment Methodology from UNECE

Supporting stakeholder engagement through organizational development support to the River Basin Organization and River Basin Council in Zarafshon river basin

Building capacity of water specialists in innovative ways

nexus

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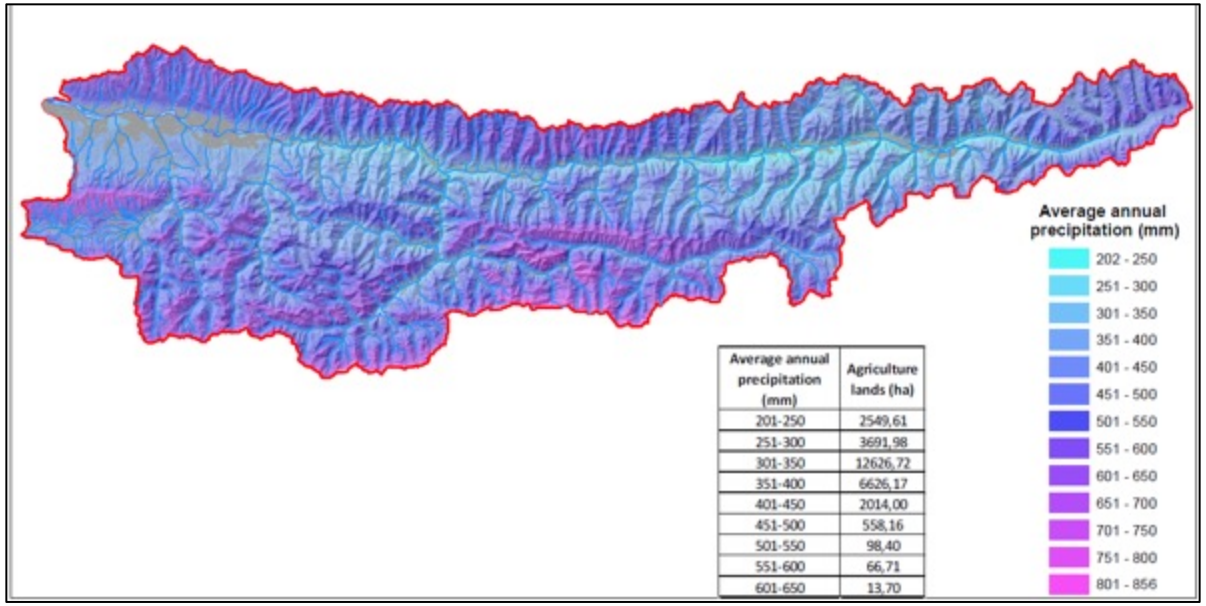
Water allocation for sectoral use in Zarafshon river basin

- Where does the water come from?
- How does it bcome available to the user across time and space?

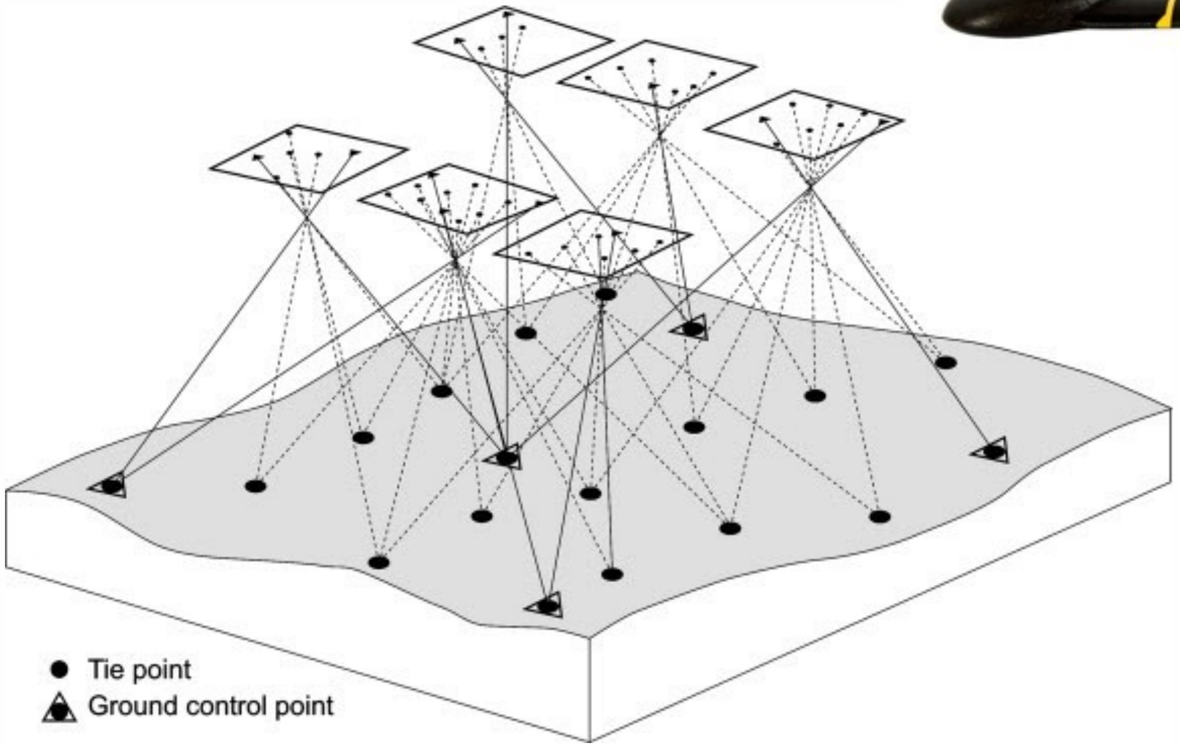
Map of precipitation and agriculture land in Zarafshon



Average annual precipitation (mm)	Agriculture lands (ha)
201-250	2549,61
251-300	3691,98
301-350	12626,72
351-400	6626,17
401-450	2014,00
451-500	558,16
501-550	98,40
551-600	66,71
601-650	13,70

66% of agriculture land is located in areas that receive less than 350 mm of precipitation on average annually

Glacier and seasonal snow monitoring for glacio-hydrological and water allocation modelling



Monitoring the cryosphere (glaciers and snow) with drone technology to know when water will become available at different time scales

Glacier expedition in Zarafshon river basin (01st - 03rd October, 2023)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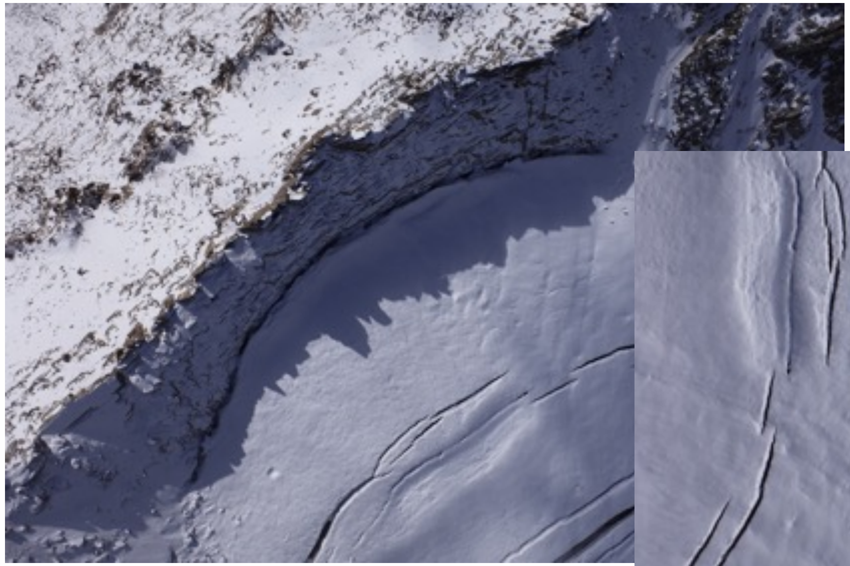

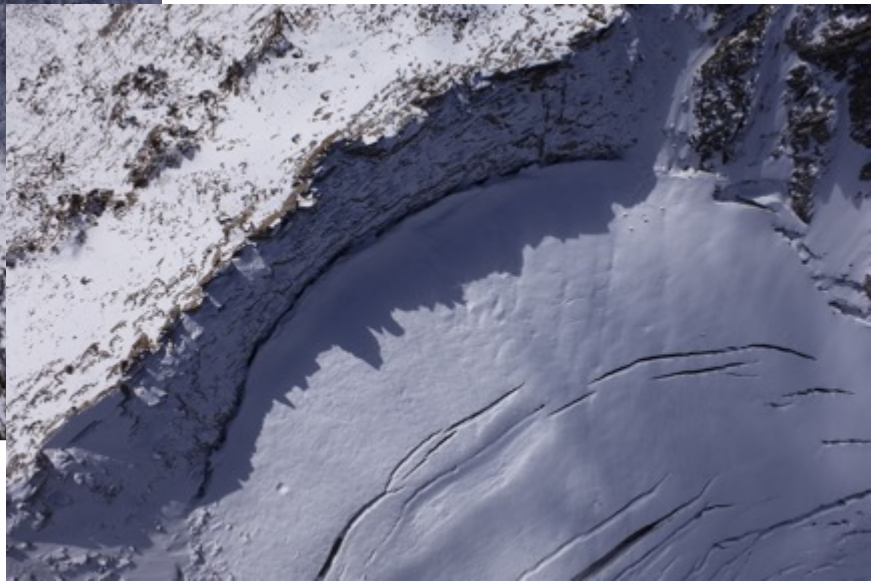

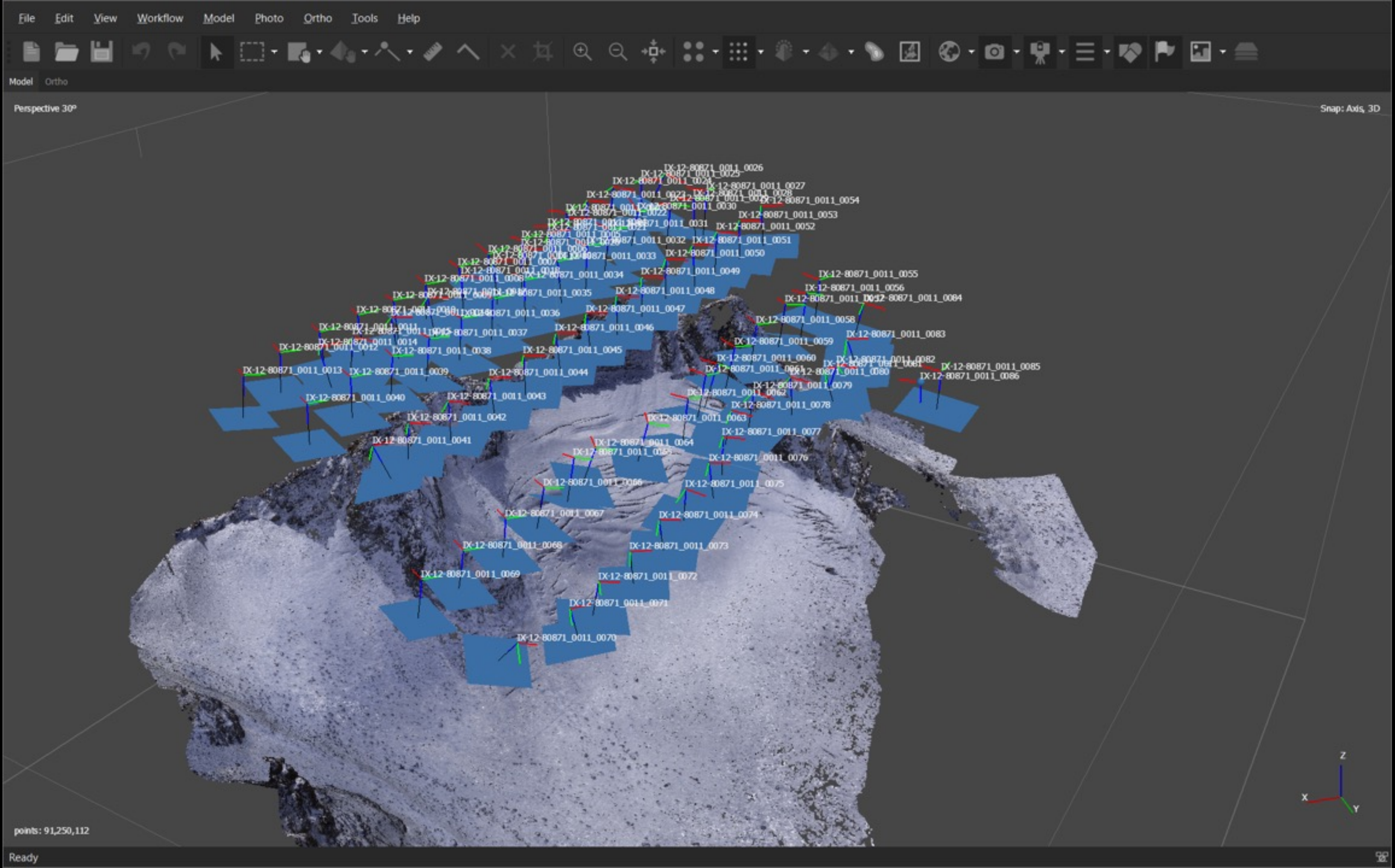

File
Edit
View
Workflow
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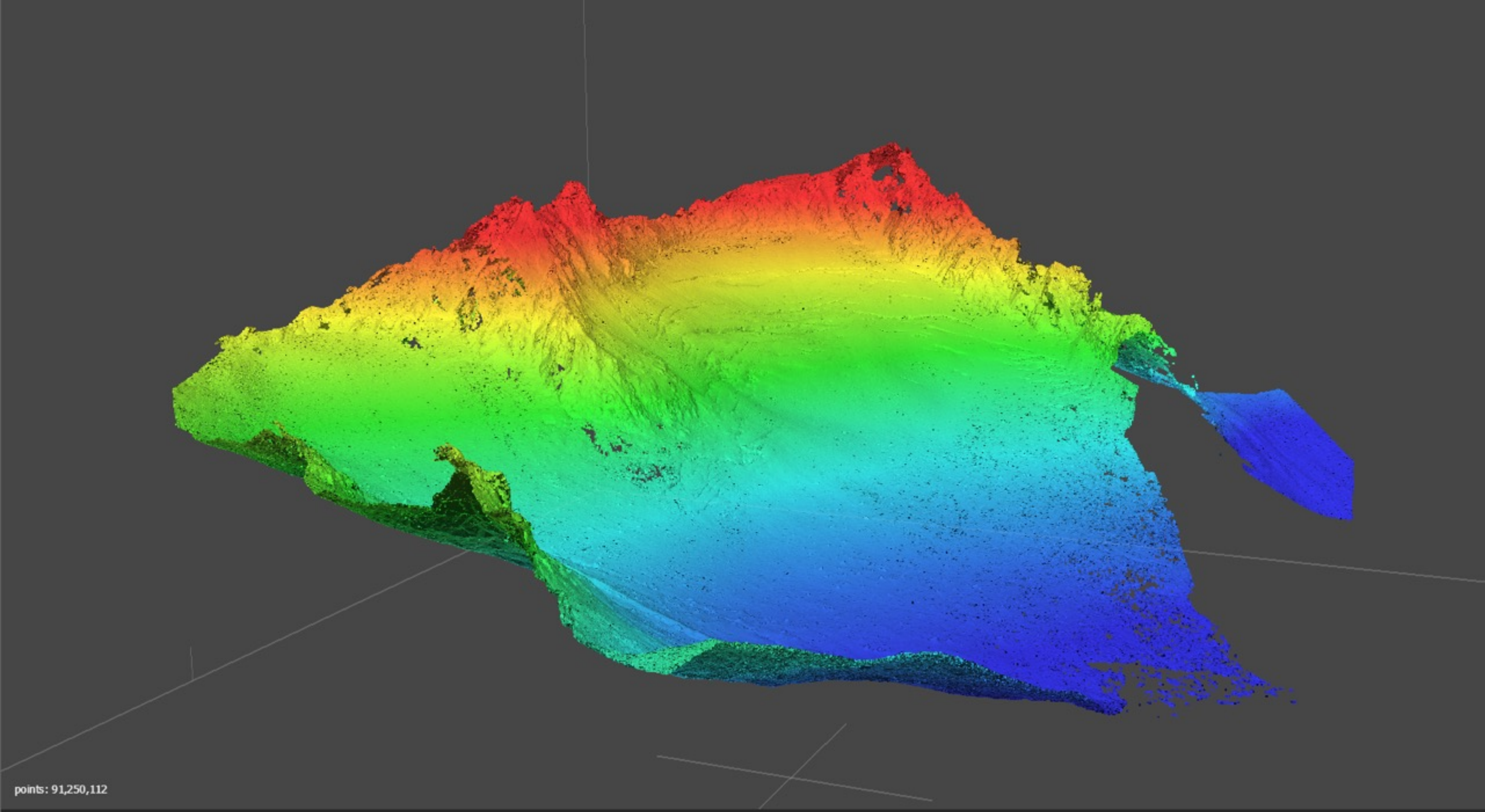
Photo
Ortho
Tools
Help
Model
Ortho
Perspective 30°
Snap: Axis, 3D
points: 91,250,112
Ready
Z
X
Y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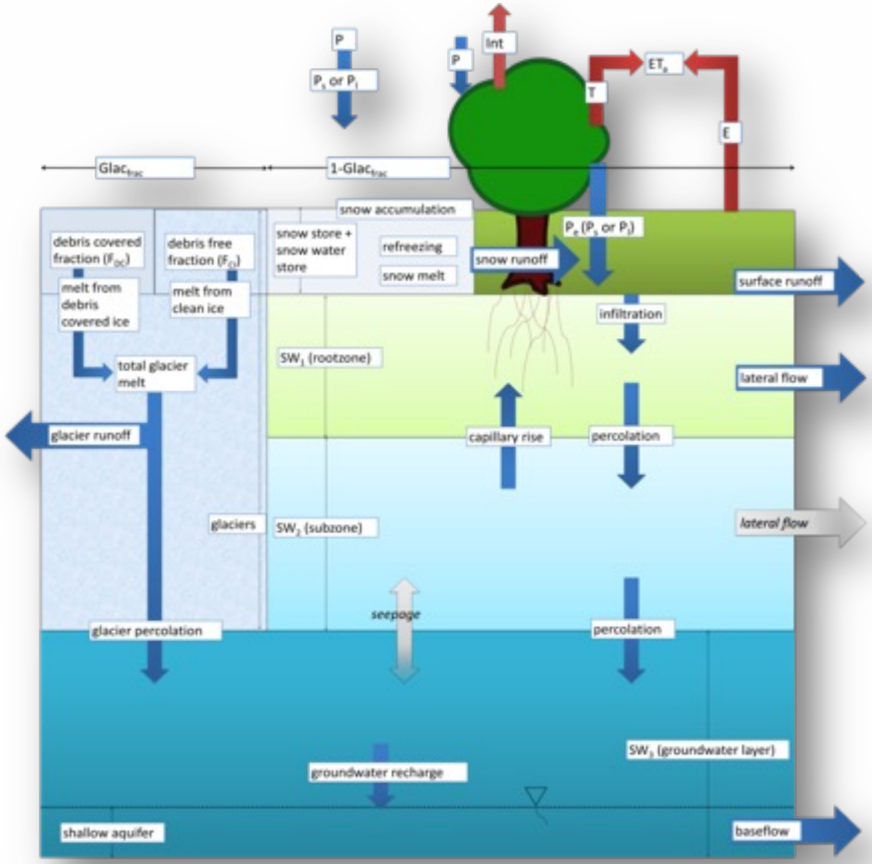
P
P or P
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Glac
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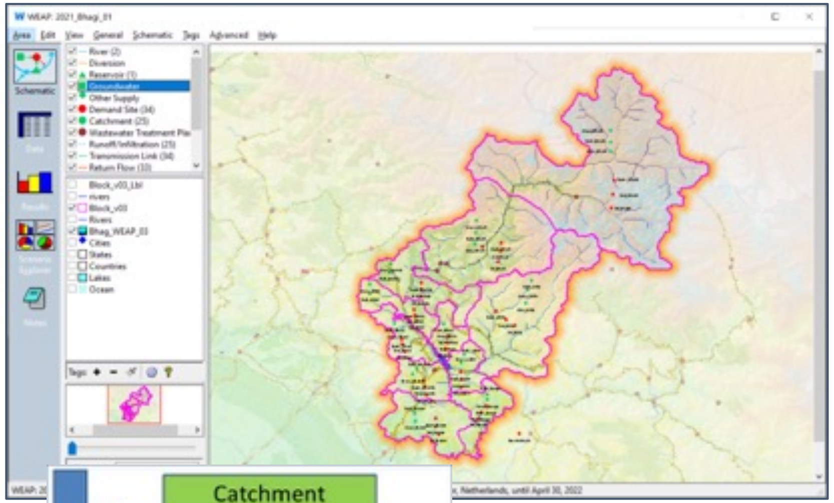
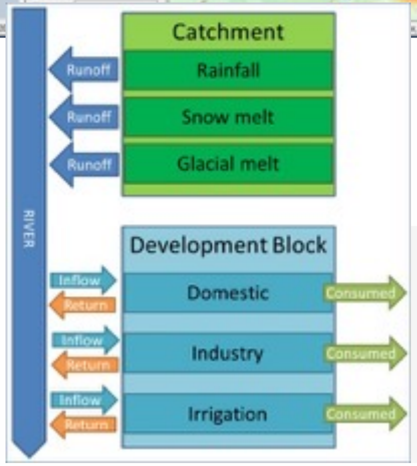
snow accumulation
debris covered fraction (F)
debris free fraction (F)
snow store + snow water store
refreezing
snow melt
snow runoff
surface runoff
melt from debris covered ice
melt from clean ice
infiltration
total glacier melt
SW (rootzone)
lateral flow
glacier runoff
capillary rise
percolation
glaciers
SW (subzone)
lateral flow
seepage
glacier percolation
percolation
SW (groundwater layer)
groundwater recharge
shallow aquifer
baseflow




RIVER
Catchment
Runoff
Rainfall
Runoff
Snow melt
Runoff
Glacial melt
Development Block
Inflow
Return
Domestic
Consumed
Inflow
Return
Industry
Consumed
Inflow
Return
Irrigation
Consumed

WEAP


Integrated Rural
Development
Project/ TRIGGER

The role of **technology** to trigger **partnership and cooperation** among local partners to improve **water allocation and planning**

MINISTRY OF ENERGY AND WATER RESOURCES OF THE REPUBLIC OF TAJIKISTAN

ИНСТИТУТ ВОДНЫХ ПРОБЛЕМ, ГИДРОЭНЕРГЕТИКИ И ЭКОЛОГИИ
ИМОГЭ&Э

Institute of Water Problems, Hydropower and Ecology of the National Academy of Sciences of Tajikistan

(built in capacity on water allocation and hydrological modelling with WEAP)

Center for Research of Glaciers of the National Academy of Sciences of Tajikistan

(built in capacity on glacier and snow monitoring and translating it into water supply)

Shaping partnerships at multiple levels, including decision makers and technical staff

Trust

Zarafshon River Basin Management Plan

Book 1. Characterization of river basin

Book 2. Key challenges for water resources management

Book 3. Targets and indicators

Book 4. Water management balance and water allocation

Book 5. Water extraction limits

Book 6. Program of measures

Improving access and use of irrigation water for small-scale farmers through irrigation efficient technologies

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Case Study 1 – Challenge

- Farmer scheme does not receive sufficient water (water access problem). Loss of 45 fruit trees.
- Water source is 2.3 km away.
- Water source depends on two irrigation water pumps that are currently burnt, due to lack of operation and maintenance
- Farmer fully relies on one source of water (water resilience problem)
- Water demand – 6.000m3/ha/year using furrow irrigation
- Farmer is not willing to pay for water nor for energy because farmer does not receive water from the central irrigation system

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Case Study 1 – Solution

- On-site water storage, pump and drip irrigation.
- Farmer is able to provide water twice a week directly from the river, increasing quantity and quality of yield.
- Water is 300 meters away.
- Farmer manages the water supply according to crop and soil requirements directly from storage fed by mountain river water
- Farmer has access now to a second water source which due to proximity can be fixed if needed.
- Water demand – 4.200m3/ha/year
- Water requirements reduced by 30%
- Farmer is willing to pay a higher energy bill in exchange of the connection to the electricity line that will bring water to the farmer's plot

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Case Study 2 – Challenge

- New land available for food production
- Farmer plots do not have enough water in the quantity and frequency needed (water access problem).
- Water source is small reservoir storage 1.5 km away and pumps burnt, due to lack of maintenance, rely on even further springs that are drying up.
- Farmer fully relies on one source of water (water resilience problem)
- Water demand – 5.000m3/ha/year using furrow irrigation
- Village power line is not enough to meet crop water requirements due to power overload or burnt power lines

Case Study 2 – Solution

- Solar water pump and drip irrigation.
- Farmer is able to provide water twice a week directly from the water reservoir storage.
- Farmer manages the water supply according to crop and soil requirements directly from water storage
- Water demand – 3.000m3/ha/year
- Water requirements reduced by 30%
- Farmer is willing to pay for metered water and would save 1920 Kw per year by using the solar water pump

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Water, energy and agricultural policy implications

- **Improved water productivity** raises agricultural production and reduces energy consumption
- **Solar renewable energy for food production** can reduce pressure on energy production through other renewable (hydropower) and non-renewable sources (coal fire electricity production) delivering **adaptation and mitigation benefits**
- Adding a second reliable water and electricity source that is closer to the user **improves food security**
- Improved water access can lead to an increase in **willingness to pay for the electricity bill**
- A **combination** of traditional and decentralized solutions improves the economic resilience of farmers

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How can the energy, water, agriculture and climate/environment sector-leading institutions work together to deliver efficient cross-sectoral, adaptation and mitigation solutions for water, energy, food and environment security?

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Integrated Rural Development Project / TRIGGER

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