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Qualitative vulnerability assessment of Albania's Agricultural Systems to Climate Change

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Qualitative vulnerability assessment of Albania's Agricultural Systems to Climate Change

Agriculture is one of the most climate-sensitive sector. Related research has reached a conclusion that climate change, *and mostly extreme events* (*heat waves, hail, strong winds, floods etc*), are becoming a great concern of policy makers, as far as effects of these changes in food supply are significant.

The main elements of climate change now and expected:

- **Temperature:** An increase in temperatures effects: more frequent *high temperature stress* and *less frequent cold temperature stress*. Increased temperature is expected to bring negative effects for the majority of agricultural crops because it increases the risk of water stress to them, increase the amount of solar radiation - can cause burning of fruits etc.
- **Precipitation effect:** Precipitation, being the primary source of soil moisture, is probably the most important factor determining the productivity of crops. It determines also the water availability which is fundamental to agriculture. The impact of climate change can occur through three major routes: (1) **drought** – a lack of water for a period of time causing severe physiological stress to plants and animals; (2) **flooding** – an excess of water for a period of time causing physiological and direct physical stress to plants and animals; and (3) **timing of water availability** – when severe lack or excess of water does not occur but its availability through the year changes so as to no longer be suitable for current agricultural practices, crops or animals.

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In response to these challenges on climate change, the World Bank and the government of Albania conducted a joint study to identify and prioritize options for climate change adaptation in the agricultural sector (Sutton et al. (2009)).

Sutton et al. (2009) states that Albanian agriculture is already being stressed by the consequences of climate change with increased exposure to high temperatures, drought, shifting seasonal patterns, increased diseases, pests, and more soil erosion.

In this presentation are provided the expected impacts of climate change :

- on crops and horticulture
- on livestock

Impacts of climate change on crops and horticulture

Table 3.1 Effect of Climate Change on Crop Yield 2040–50 Relative to Current Yields under Medium-Impact Scenario, No Irrigation Water Constraints and without New Adaptation Measures
% change

Irrigated/rainfed	Crop	Intermediate	Lowlands	Northern Mountains	Southern Highlands
Irrigated	Alfalfa	6	4	6	13
	Maize	-3	-4	-11	1
	Tomatoes	0	-11	-8	-4
	Watermelon	N/A	-6	N/A	N/A
Rainfed	Alfalfa	-6	-3	-2	7
	Grapes	-17	-20	-21	-18
	Grassland	-5	-3	-7	10
	Olives	-3	-21	N/A	N/A
	Wheat	10	7	24	20

Note: Results are average changes in crop yield, assuming no effect of carbon dioxide fertilization, under medium-impact scenario (no adaptation and no irrigation water constraints). Declines in yield are shown in shades of orange, with darkest representing biggest declines; Increases are shaded green, with darkest representing the biggest increases. N/A = crop is not grown in that AEZ, according to local stakeholders.

Overall, the effects of climate change on crops in Albania could be relatively modest, especially for wheat, alfalfa, and pasture. There is potential for more substantial effects on vegetable and fruit crops, such as tomatoes, watermelons, and grapes, which could suffer from heat and drought stress, particularly during critical periods of their growth. One reason for the relatively modest effects is the widespread use of irrigation in Albania. However, since the irrigation infrastructure is in poor repair, water may not be available at critical times of the growing season, which would mean that the severity of effects of future climate change for irrigated crops may be underestimated.

Table 3.1 shows the results for the medium scenario, where the most crops are affected negatively by climate change, except for alfalfa and winter wheat.

Impacts of climate change on crops and horticulture

- The high-impact climate scenario has the strongest impact, with less rainfall and higher evapotranspiration due to the higher temperature projection.
- For the medium climate scenario the impact of climate change is a little less severe than the high impact scenario, as this scenario is less pessimistic in terms of rainfall projections.
- The low-impact scenario shows a net positive impact for most crops, as the increased rainfall amounts increase the water available to the plants.

In general the results indicate that:

- Grapes and olives, which are rainfed crops in Albania, have a high potential for yield declines.
- Pasture, wheat, and irrigated alfalfa have a high potential for yield increases under all scenarios, due to beneficial effects of higher temperatures and a longer growing season.
- Tomato yields outside of greenhouses with climate controls may fall modestly. Given that tomatoes are mostly an irrigated crop in Albania, the main potential climate factor for tomatoes is temperature stress.
- The results presented above do not incorporate the effects of higher CO₂ concentrations.
- For the *high-impact scenario*, some of the crops experience an increase in production due to the assumed CO₂ fertilization effect. This effect compensates part of the negative impact of the increased water stress. For other crops (grapes, grassland) the impact under this scenario remains negative and the impact on crop yields are considerable.
- For the medium- and low-impact climate scenario, CO₂ fertilization is positive and enhances yields by about 7 percent on average.

Impacts of climate change on crops and horticulture

Table 3.3 Irrigation Water Requirement Changes Relative to Current Situation to 2040s under the Three Climate Scenarios, for Each Crop and AEZ (Assuming No CO₂ Fertilization)
% change

Scenario	Crop	Intermediate	Coastal Lowlands	Northern Mountains	Southern Highlands
High	Alfalfa irrigated	5	0	-7	-23
	Maize	46	25	36	16
	Tomatoes	100	61	14	61
	Watermelon	N/A	31	N/A	N/A
Medium	Alfalfa irrigated	-2	-5	-12	-16
	Maize	22	14	24	6
	Tomatoes	46	83	7	41
	Watermelon	N/A	23	N/A	N/A
Low	Alfalfa irrigated	-12	-7	-12	-21
	Maize	7	7	5	3
	Tomatoes	32	103	8	60
	Watermelon	N/A	16	N/A	N/A

Note: N/A = the crop is not grown in the AEZ. Orange indicates an increase in crop irrigation water requirements, while green indicates a decrease.

- For the irrigated crops, the climate impact on irrigation water demand was also assessed, as a key input to the water resources analyses.
- In table 3.3, orange indicates an increase in crop irrigation water requirements, while green indicates a decrease. For the medium- and high-impact scenarios, the overall trend is that *more water is required to maintain the current yields*. Especially tomatoes and maize will need substantial increased amounts of water.
- The low-impact scenario forecasts more rainfall, including during the cropping period, which results in a slight decrease in water demands.

Climate Impacts on Livestock

- Livestock are sensitive to temperature, and studies show that climate change will have positive effects on livestock productivity by raising temperatures in winter; however, this effect will be outweighed by the negative effects of hotter summers.
- **Indirect effect:** changes in feed resources, changes in the yields of crops. Effects will depend significantly on location, system and species. Effects on alfalfa and rain fed pasture crops mentioned above, present *an indirect effect* of climate change risk to livestock. As mentioned above, for the medium scenario, *rain fed alfalfa and grassland yields are expected to increase* in the Northern Mountains and Southern Highlands AEZs, where livestock are most concentrated. Effects of climate change on maize yields may also be linked to effects on livestock. Even under the high-impact scenario, effects on these crops in the higher-elevation regions of Albania are relatively modest, with temperature effects being a lift to yield that generally balances or outweighs the negative effects of less precipitation.
- **As a result, the indirect effects of climate change in areas where livestock are most important would range from relatively modest in the worst case, to beneficial in the best case.**
- **The direct effects** will include, for example, higher temperatures and changing rainfall patterns, leading to the *increased spread of existing vector-borne diseases and macro-parasites*, accompanied by circulation of new diseases.
- The direct effect of climate change on livestock is linked to higher-than-optimal temperatures for livestock, in which heat can affect animal productivity and, in the case of extreme events, may lead to elevated mortality rates related to extreme heat stress.
- For many livestock type/AEZ combinations, climate change is a major risk, with potential for as much as 35 percent loss in net revenue by the 2040s, with effects on goats and sheep being less than those for chickens and cattle.

By Sutton et al (2009), there is limited information to characterize the direct effects of climate on livestock; the methodologies currently available are far less sophisticated than the crop modeling techniques and are generally not applicable to Albania.

Thank you for your
attention !