Discussion about possible research topics

1. Impact of humus accumulation techniques on moisture and carbon storage

2. Impact of pasture degradation on carbon emissions

3. Impact of climate change on water availability

германия
кызматташтыгы
DEUTSCHE ZUSAMMENARBEIT

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Minimum tillage / zero tillage on Rain Fed Land Production System

Observation: Rain-fed land on which minimum tillage – plus other innovations- is used have higher yields. The effect of each single factor such as winter sowing, timely fertilizing, minimum tillage, leaving mulch on the field, etc. is unknown, however, the difference to traditional farming was much larger in dry years.

It seems obvious that moisture is one of the reasons for increased yields, assumably through increased humus content in the soil and / or better water availability when demand of the plants is high

Can we quantify this?
Research questions

- Quantification of impact of minimum or zero tillage on **humus content/ organic matter content** of the soil
- Change in **water absorption capacities of the soil** along with increased humus content

- How much more humus /organic matter can be accumulated through **establishment of a mulch layer?**
- Which **best methodologies** exist or can be developed to establish such mulch layer?

- **Is such research relevant?**

Minimum tillage / zero tillage on RAIN FED LAND PRODUCTION SYSTEM

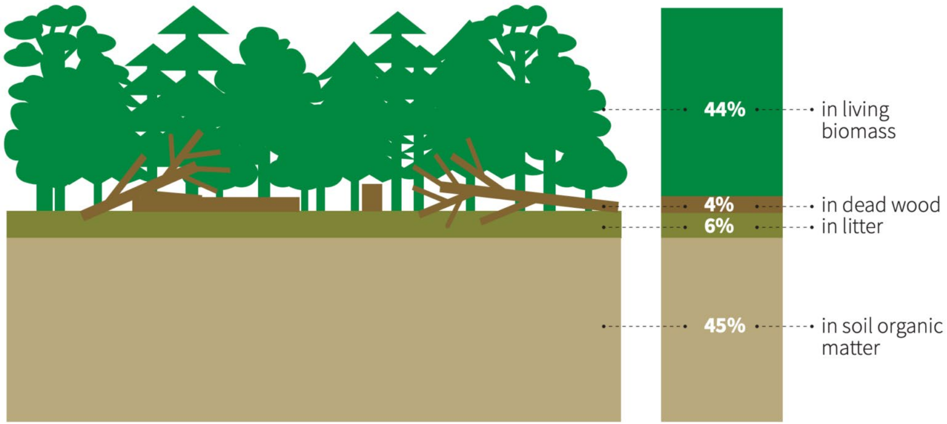
Relevance of research - Food security

Rainfed agriculture may become the backbone for food security in the country:

- More than 1/3rd (>400.000 ha) are rainfed land in Kyrgyzstan. Wheat is the dominating crop and will remain to be it
- Winter wheat on rainfed land uses the available moisture of the soil (from autumn to early summer) while most other crops growing during the summer season require irrigation.
- Average yields (summer wheat and barley) on traditional rainfed land is 1 to 1,5 t/ha and far below the potential
- Income from these fields is very low, farmers pay little attention to the cereals on rainfed land
- Risk that production might discontinue if draught from climate change is not compensated by climate smart agriculture
- Assumption 300.000 ha of cereals including winter wheat x 2 t/ha/ year (average improved production) / 6.000.000 inhabitants = 100 kg cereals per person / year

Minimum tillage / zero tillage on RAIN FED LAND PRODUCTION SYSTEM

Proportion of carbon stock in forest carbon pools, 2020



- **Research** about carbon storage potential in soils when humus content increases through minimum tillage and / or mulching in Central Asia

Impact of minimum / zero tillage on Decarbonisation

Based on the quantification of humus /organic matter in the soil through minimum tillage and / or mulching:

How much carbon will / can be stored in the soil?

High potential for positive climate impact from both, minimum tillage and mulching

- Assumption: carbon storage is 250 to 300 kg/ha (about one t of CO_2eq per year)
- Hypothesis: A total of 400.000 t CO_2eq could be absorbed **if** climate smart agriculture would reach out all rainfed lands

- **Relevance is not doubtable**

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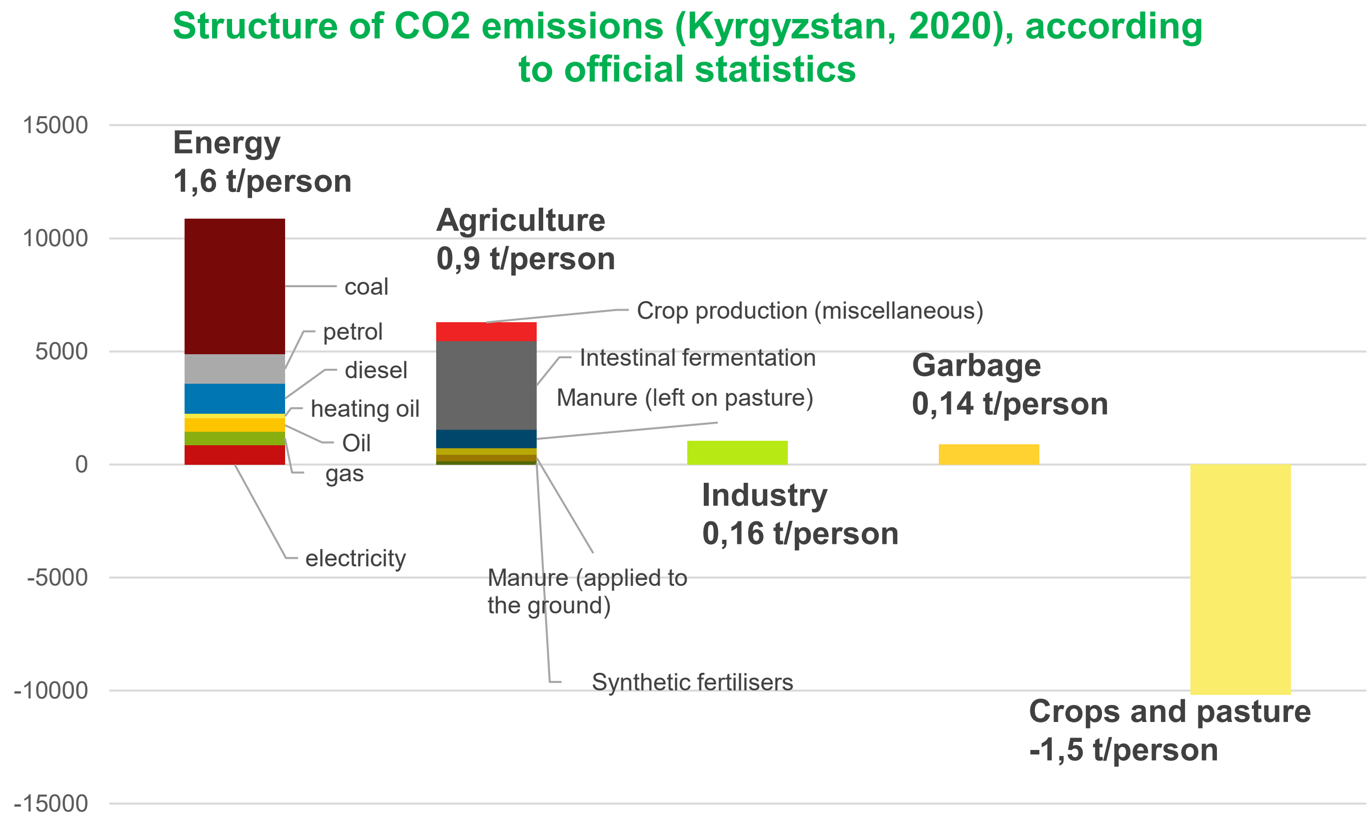
Pasture degradation and impact on carbon emissions

Total emissions - 2.77 tons of CO2 per inhabitant of Kyrgyzstan

- 60% comes from consumption of energy resources (for heating, lighting, transportation, etc.).
- 30% - from agriculture,
- >5% - from industry,
- <5% - from garbage



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Pasture degradation and impact on carbon emissions

Hypothesis: current pasture use and degradation produces "hidden" carbon emissions

Fact:

- 9 Mio ha pasture in Kyrgyzstan – official data;

Estimation:

- Pasture productivity decreased by 50% during the last 30 years – according to the Ministry of Agriculture
- In total 0,3% humus loss during the last 30 years assumed based on humus loss on arable land;
- Average Kyrgyz population during the last 30 years: 5 Mio people

Calculation:

- 1 % humus/ ha equals a total storage of about 24 t carbon/ha (average data for soils), 1 kg carbon equals 3,66 kg $CO_{2,}$ 1,6 t of CO2 eq per year and person (non-considered emission) only from unsustainable pasture use (about 3t CO2 eq/year per person in official IPPC* reporting)
- Potential emissions from pasture degradation are not reflected in the carbon monitoring system of the Kyrgyz Republic (MRV, third national communication under the UN Framework Convention on Climate Change).

Research topic: A scientific quantification of the current level of emissions caused by pasture degradation and possible quantity of "carbon capture" through pasture regeneration.

*IPPC: Intergovernmental Panel on Climate Change

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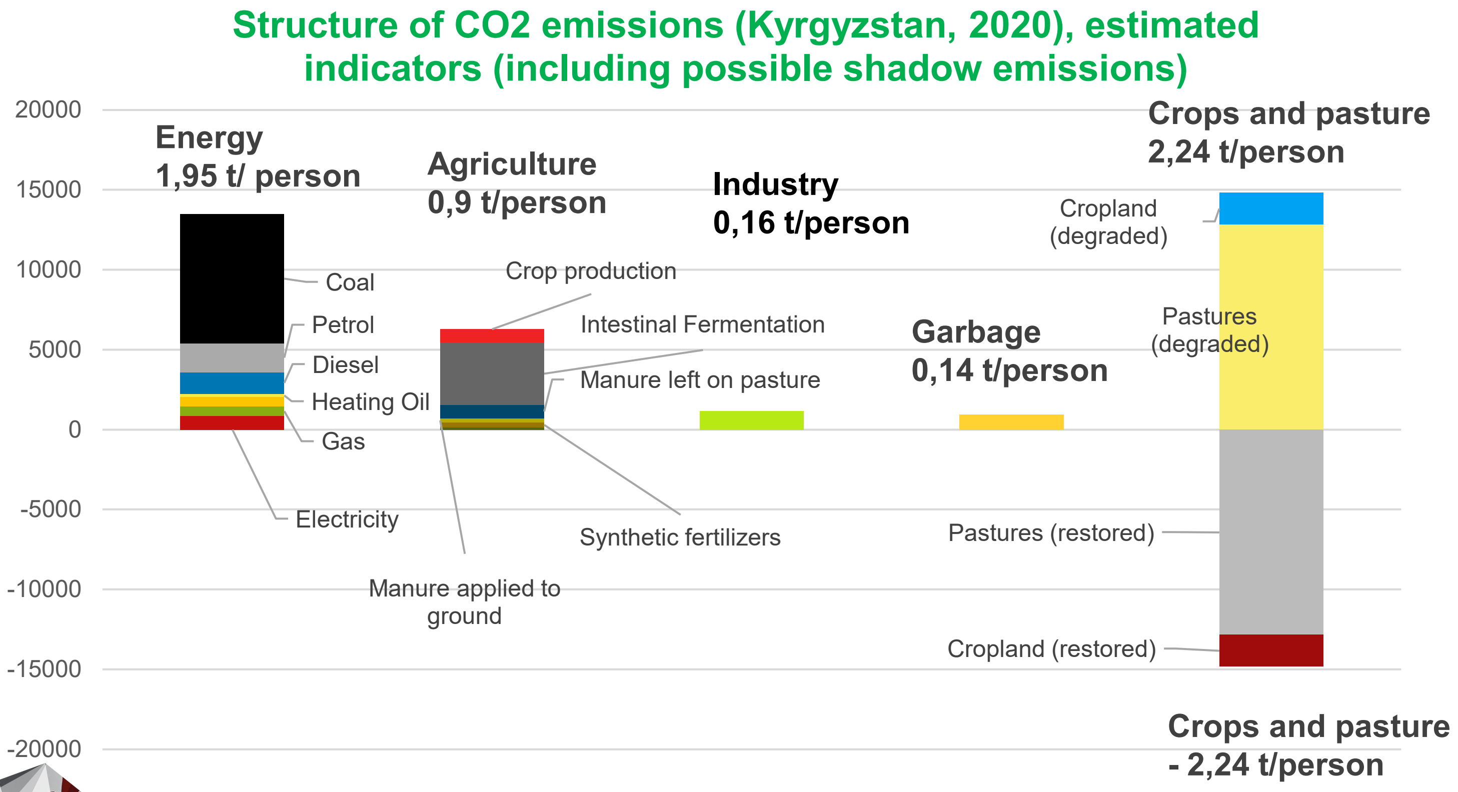
Pasture degradation and impact on carbon emissions

Total emissions - 5.3 tons of CO2 per inhabitant of Kyrgyzstan



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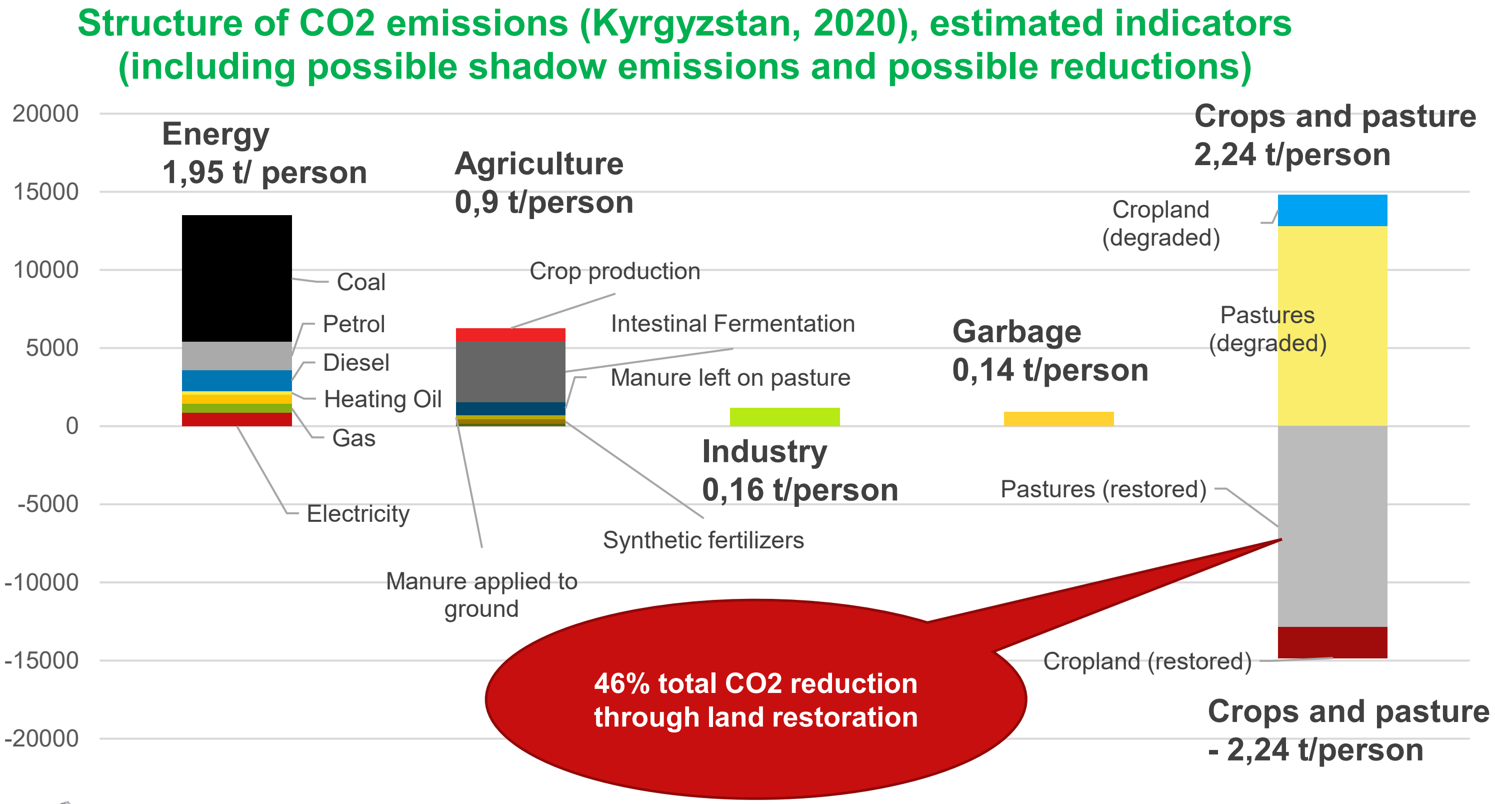
Pasture restoration and impact on carbon reduction

Contributions to emission reductions can be made by activities in agriculture, through restoration:

Pastures;

Arable land



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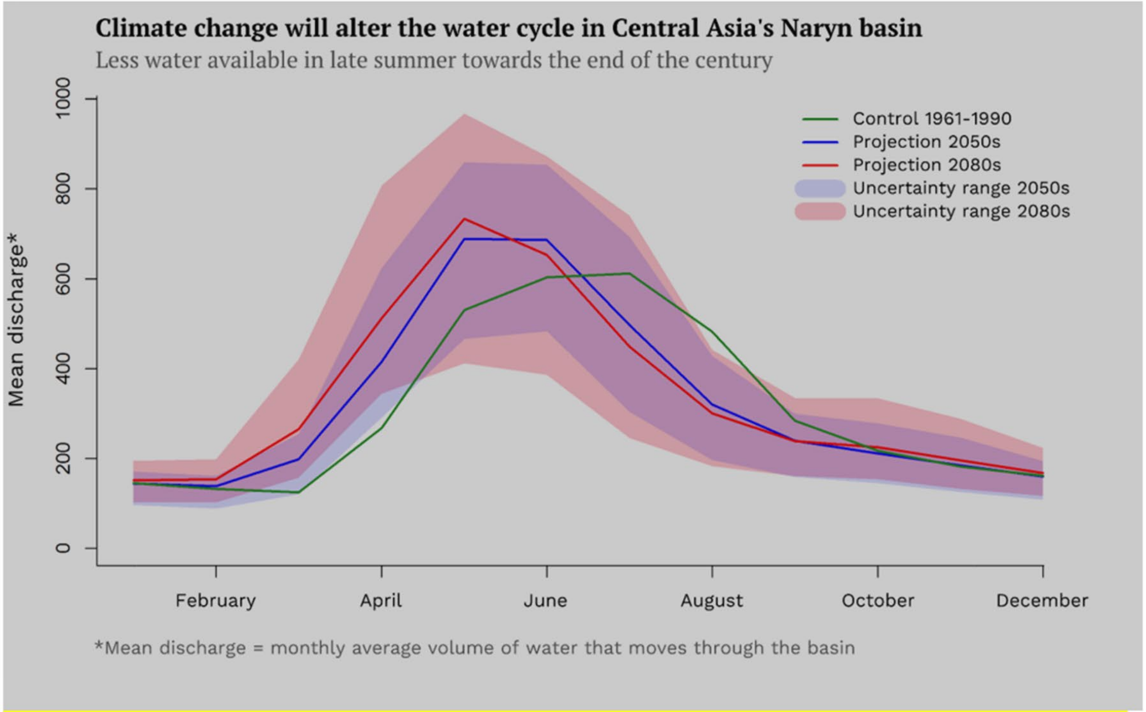
Changes of irrigation water availability (impact of climate change on agriculture)

Uncertain if in total more or less water will be available per year

However, the seasonal availability will change:

- less water available during July and August
- more water available in early season since the snow will melt earlier if average temperatures increase



Variation of water availability in the Naryn Basin, GFZ-Potsdam, 2017

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Changes of irrigation water availability (impact of climate change on livelihoods)

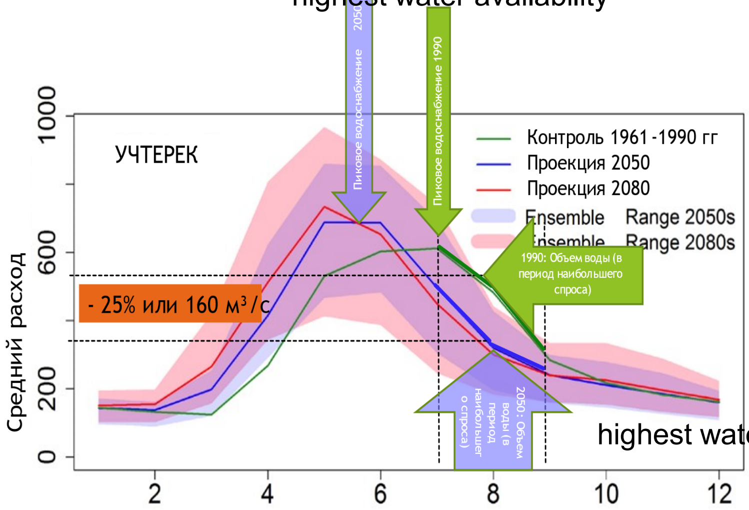
Research Questions:

- How many ha of irrigated land are served directly from a primary source (river) and not from a seasonal reservoir?
- Can we do more precise regional prediction based on newer climate models?
  Is there a possibility to make predictions for other basins (or are they available) – e.g. Batken area?

Practical application of the research question

Those areas not supplied from a seasonal reservoir will suffer most from the change. Climate change adaptation measures (e.g. reduction of water losses from the source to the field – currently often as high as 50%) are not cheap but feasible and shall be focused on regions that are likely to suffer most.

Variation of water availability in the Naryn Basin



Increase of global temperature leads to earlier snow melt, less water is available in peak water demand (August)

Прямое воздействие на сельские районы!

According to the diagram a reduction of water availability of 25% (160 m3 / s) should be expected for the months of July to August

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Thank you for your attention!

Käthe Brakhan, IRDP project leader, GIZ GmbH
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