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# Challenges for Land Use Functions in Central Asia

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# Outline

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3. Method
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# 1. Introduction

- Agriculture remains an important sector in the economy of Central Asia providing economic and social stability
  - GDP: Kazakhstan → 5.2%; Kyrgyzstan → 20.8%; Tajikistan → 23.3%; Turkmenistan → 7.5%;  Uzbekistan → 18.5%
- Change of climate in the region however, have caused significant impacts on agricultural production, ecosystems, and human health
- Transboundary water management issues have further resulted in a decline of agricultural production in the region
- Advancing desertification and soil degradation in the Aral Sea area further impedes the region's sustainable land use practices

# Problem statement

- Increase of dust storms lead to human health deterioration
- Salinization has now plagued about 50% of the irrigated lands of Central Asia
- Annual withdrawal of highly salinized land out of crop production costs US$ 12 million in Uzbekistan (Dubovyk et al. 2013)
- Low economic return on water compared

# Problem statement

- Heavily salinized irrigation and drainage canals adversely impacts environmental, economic and social improvements in the region
- Comprehensive knowledge is needed
- Research can provide this knowledge base
- Meta-analysis of existing scientific literature can:
  a) detect blind spots
  b) identify knowledge base

Source: Courtesy of Dagmar Balla

# Research objective

Aim:

- Analyse the current international literature on agricultural land use in Central Asia and its relevance to sustainable development

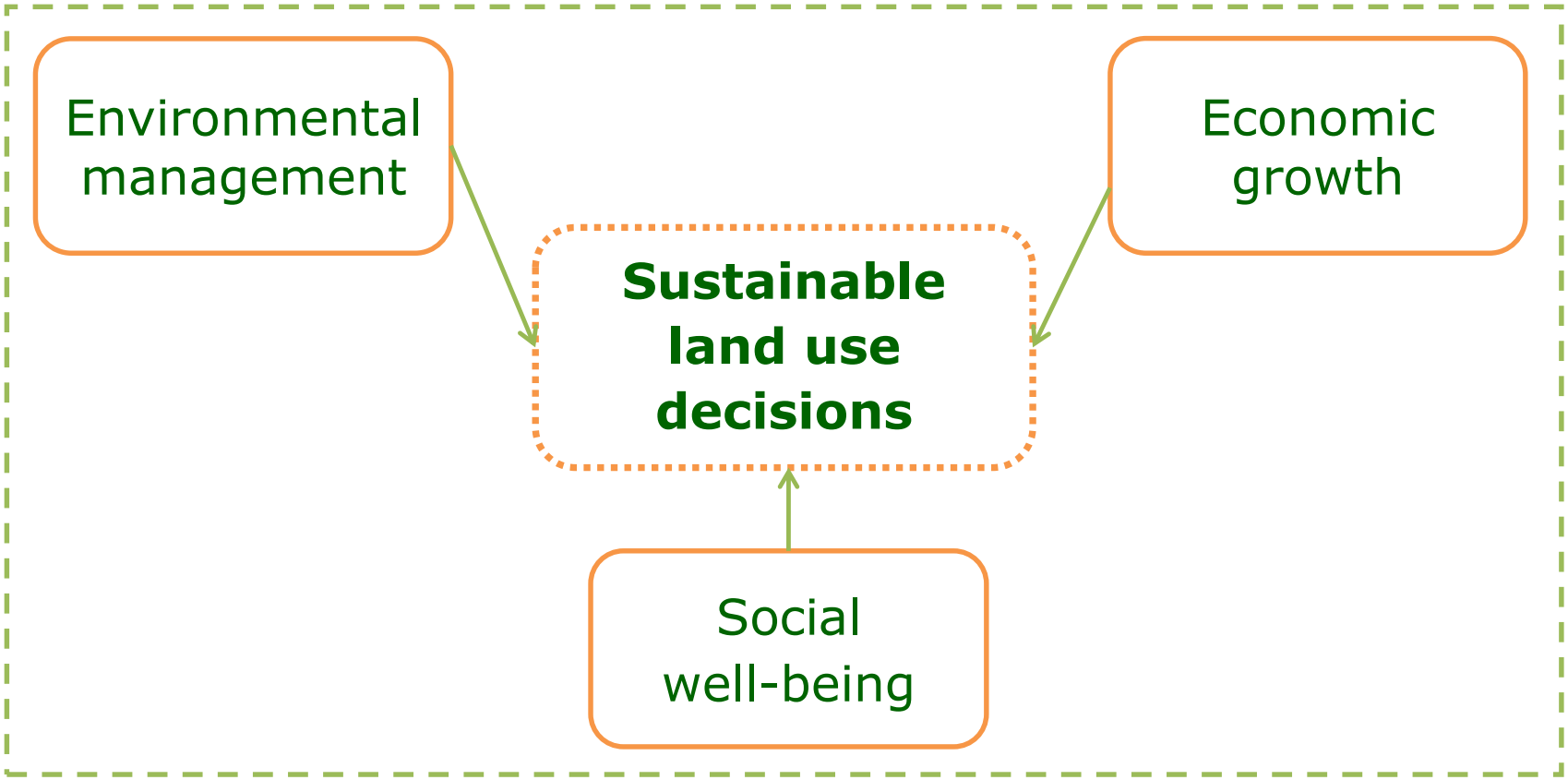
Research questions:

- What are the type and relative shares of environmental, economic and social aspects of agricultural land use in Central Asia?
- Where are the existing knowledge gaps and the need for future research on sustainable land use?

# 2. Land Use Functions

- Sustainable development has become a paradigm for policy making worldwide (WCED 1987)
- It requires knowledge and the simultaneous consideration of environmental, economic and social dimensions during decision-making (ibid.)
- In the case of land use, the Land Use Functions (LUFs) framework helps to operationalize the concept of sustainable development (Helming et al. 2011)

# Land Use Functions framework




Source: Adapted from Perez-Soba et al. (2008)

# Definition of the framework

- LUFs are defined as "the goods and services provided by the different land uses that summarise the most relevant environmental, economic and societal issues of a region" (Perez-Soba et al. 2008)
- It takes into account all three sustainability dimensions (environmental, economic and social) in to land use decisions
- A large number of indicators are grouped into nine LUF categories that are classified by the three sustainability pillars:
  - Environmental: Abiotic, biotic, and ecosystem processes
  - Economic: Land-based production, market, and transport/infrastructure
  - Social: Employment, health, and culture

# LUFs in relation to CA context

| Sustaina-bility dimension | Land use functions (LUFs) | Taxonomy of activities |
|---|---|---|
| Environ-mental | LUF 1 | Physical & chemical properties of soils, water & air quality |
| | LUF 2 | Habitats for fauna and flora, and other organisms |
| | LUF 3 | Ecosystem services, land degradation, soil fertility, and arable lands |
| Economic | LUF 4 | Crop yields, value chains, biomass production |
| | LUF 5 | Market mechanisms, financial services, rural banks, and property rights on land |
| | LUF 6 | Irrigation infrastructure, transboundary water conveyances, large-scale water projects |
| Social | LUF 7 | Provision of job opportunities, income, livelihood security |
| | LUF 8 | Human health, nutrition, food security |
| | LUF 9 | The use of landscape for the purpose of cultural heritage. The issue of gender in land access |

# 3. Method: Study area

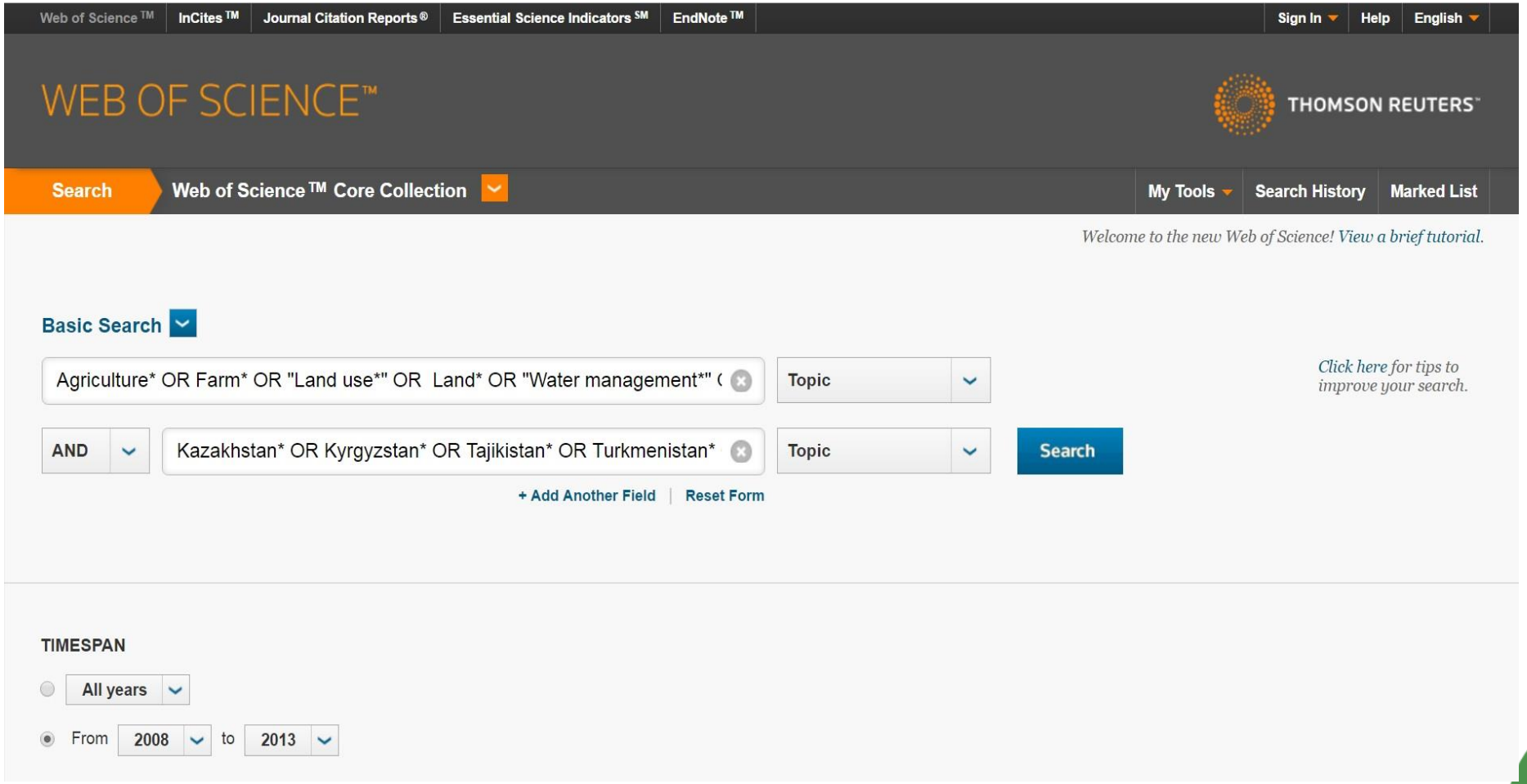
- Central Asia comprises the five former Soviet Union republics: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan
- It covers about 4 million km$^2$ area and has a total population of 65 million
  - Total agricultural land is approximately 280 million hectare (Mha), out of which only 7% is arable land


Source: http://origins.osu.edu/article/69/maps

# Database search

- A systematic database search of peer-reviewed articles was conducted using the electronic Web of Science
- English-language articles that were published between 2008 and 2013 were selected
- Search terms used:
  - Thematic search: Agriculture* OR Farm* OR "Land use*" OR Land* OR "Water management*" OR Irrigation* AND
  - Regional search: Kazakhstan* OR Kyrgyzstan* OR Tajikistan* OR Turkmenistan* OR Uzbekistan* OR "Central Asia*"
- Documents were considered relevant if they matched at least one of the regional search terms and one of the topical search terms in **title, abstract** or **keywords**
- Based on title, abstract and keywords, each article was assigned to one or several of nine LUF categories
  - In case of uncertainties, the entire paper was reviewed and assigned to LUFs

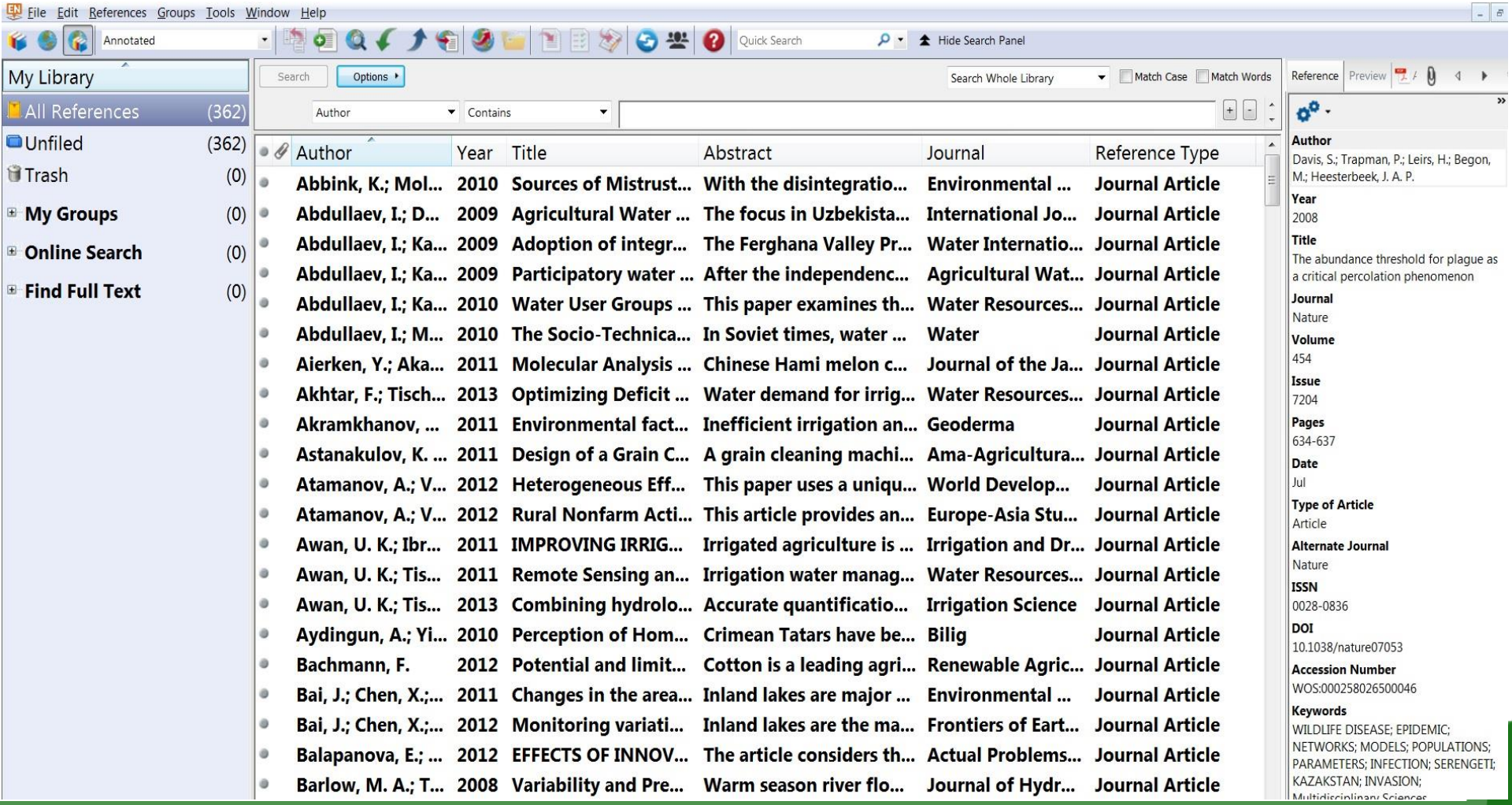
# Database search



# 4. Results and discussion

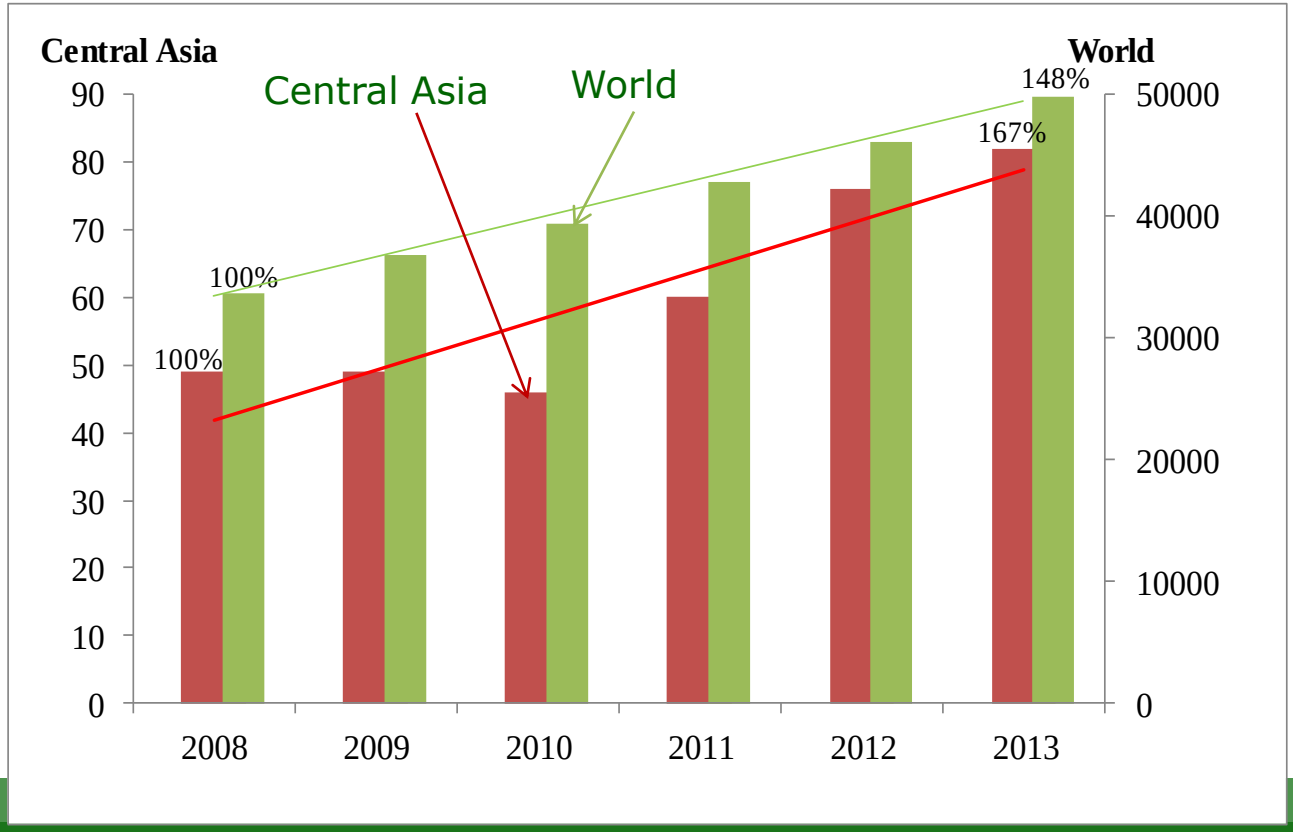
- The automated database search returned a total of 700 papers
- Of these, 362 articles (52%) were relevant to agricultural land use in Central Asia
- The remaining articles were removed from the database because of their irrelevance to the geographic area or to agricultural land use
  - For instance, some papers referred to the eastern part of China (Xinjiang), Afghanistan, and Mongolia as Central Asia
  - Additionally, some papers referred to the thematic search terms we used in the abstract, but the detailed review of the abstract and, in some cases, the whole paper indicated its irrelevance to agricultural land use

# EndNote


File Edit References Groups Tools Window Help
Annotated
Quick Search
Hide Search Panel
My Library
All References (362)
Unfiled (362)
Trash (0)
My Groups (0)
Online Search (0)
Find Full Text (0)
Search
Options
Search Whole Library
Match Case
Match Words
Author
Contains
Reference
Preview
Author | Year | Title | Abstract | Journal | Reference Type
Abbink, K.; Mol... | 2010 | Sources of Mistrust... | With the disintegratio... | Environmental ... | Journal Article
Abdullaev, I.; D... | 2009 | Agricultural Water ... | The focus in Uzbekista... | International Jo... | Journal Article
Abdullaev, I.; Ka... | 2009 | Adoption of integr... | The Ferghana Valley Pr... | Water Internatio... | Journal Article
Abdullaev, I.; Ka... | 2009 | Participatory water ... | After the independenc... | Agricultural Wat... | Journal Article
Abdullaev, I.; Ka... | 2010 | Water User Groups ... | This paper examines th... | Water Resources... | Journal Article
Abdullaev, I.; M... | 2010 | The Socio-Technica... | In Soviet times, water ... | Water | Journal Article
Aierken, Y.; Aka... | 2011 | Molecular Analysis ... | Chinese Hami melon c... | Journal of the Ja... | Journal Article
Akhtar, F.; Tisch... | 2013 | Optimizing Deficit ... | Water demand for irrig... | Water Resources... | Journal Article
Akramkhanov, ... | 2011 | Environmental fact... | Inefficient irrigation an... | Geoderma | Journal Article
Astanakulov, K. ... | 2011 | Design of a Grain C... | A grain cleaning machi... | Ama-Agricultura... | Journal Article
Atamanov, A.; V... | 2012 | Heterogeneous Eff... | This paper uses a uniqu... | World Develop... | Journal Article
Atamanov, A.; V... | 2012 | Rural Nonfarm Acti... | This article provides an... | Europe-Asia Stu... | Journal Article
Awan, U. K.; Ibr... | 2011 | IMPROVING IRRIG... | Irrigated agriculture is ... | Irrigation and Dr... | Journal Article
Awan, U. K.; Tis... | 2011 | Remote Sensing an... | Irrigation water manag... | Water Resources... | Journal Article
Awan, U. K.; Tis... | 2013 | Combining hydrolo... | Accurate quantificatio... | Irrigation Science | Journal Article
Aydingun, A.; Yi... | 2010 | Perception of Hom... | Crimean Tatars have be... | Bilig | Journal Article
Bachmann, F. | 2012 | Potential and limit... | Cotton is a leading agri... | Renewable Agric... | Journal Article
Bai, J.; Chen, X.;... | 2011 | Changes in the area... | Inland lakes are major ... | Environmental ... | Journal Article
Bai, J.; Chen, X.;... | 2012 | Monitoring variati... | Inland lakes are the ma... | Frontiers of Eart... | Journal Article
Balapanova, E.; ... | 2012 | EFFECTS OF INNOV... | The article considers th... | Actual Problems... | Journal Article
Barlow, M. A.; T... | 2008 | Variability and Pre... | Warm season river flo... | Journal of Hydr... | Journal Article
Author
Davis, S.; Trapman, P.; Leirs, H.; Begon, M.; Heesterbeek, J. A. P.
Year
2008
Title
The abundance threshold for plague as a critical percolation phenomenon
Journal
Nature
Volume
454
Issue
7204
Pages
634-637
Date
Jul
Type of Article
Article
Alternate Journal
Nature
ISSN
0028-0836
DOI
10.1038/nature07053
Accession Number
WOS:000258026500046
Keywords
WILDLIFE DISEASE; EPIDEMIC; NETWORKS; MODELS; POPULATIONS; PARAMETERS; INFECTION; SERENGETI; KAZAKSTAN; INVASION;

# Number of LUF-related publications

- Number of LUF articles are generally increasing overtime
  - Due primarily to the engagement of international research groups in the region

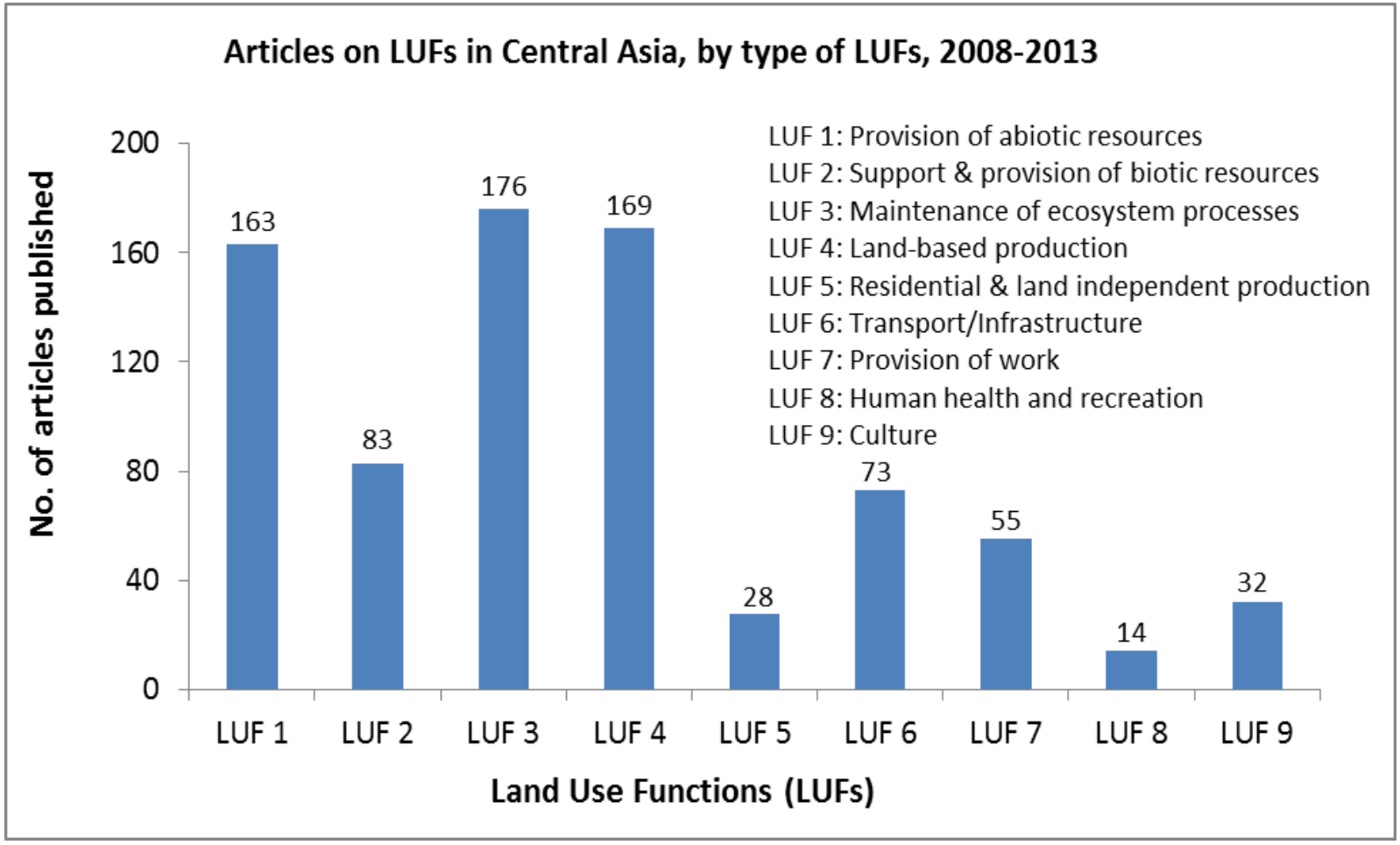


# Distribution of Land Use Functions

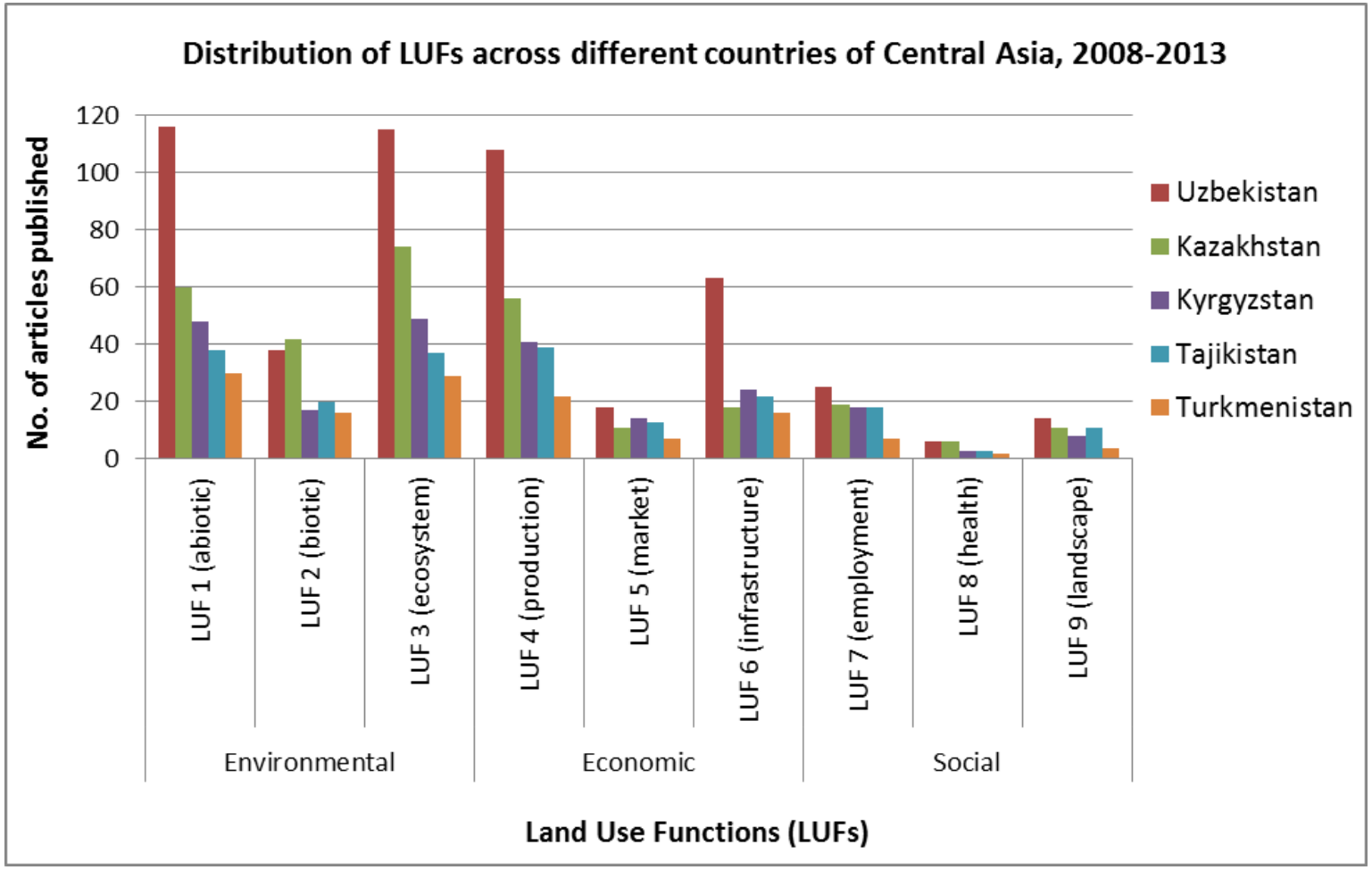
- Most of the papers deal with some aspects of the environment associated with agricultural land use
- It confirms the critical role of agriculture for environmental degradation in CA, e.g. the drying up of the Aral Sea
- Of the 362 papers analyzed:
  - The environmental aspects of land use were most often addressed (422 times*)
  - followed by the economic aspects of land use (270 times)
  - the social aspects of land use were least often addressed (101 times).

* each paper could be allocated to more than one Land Use Function

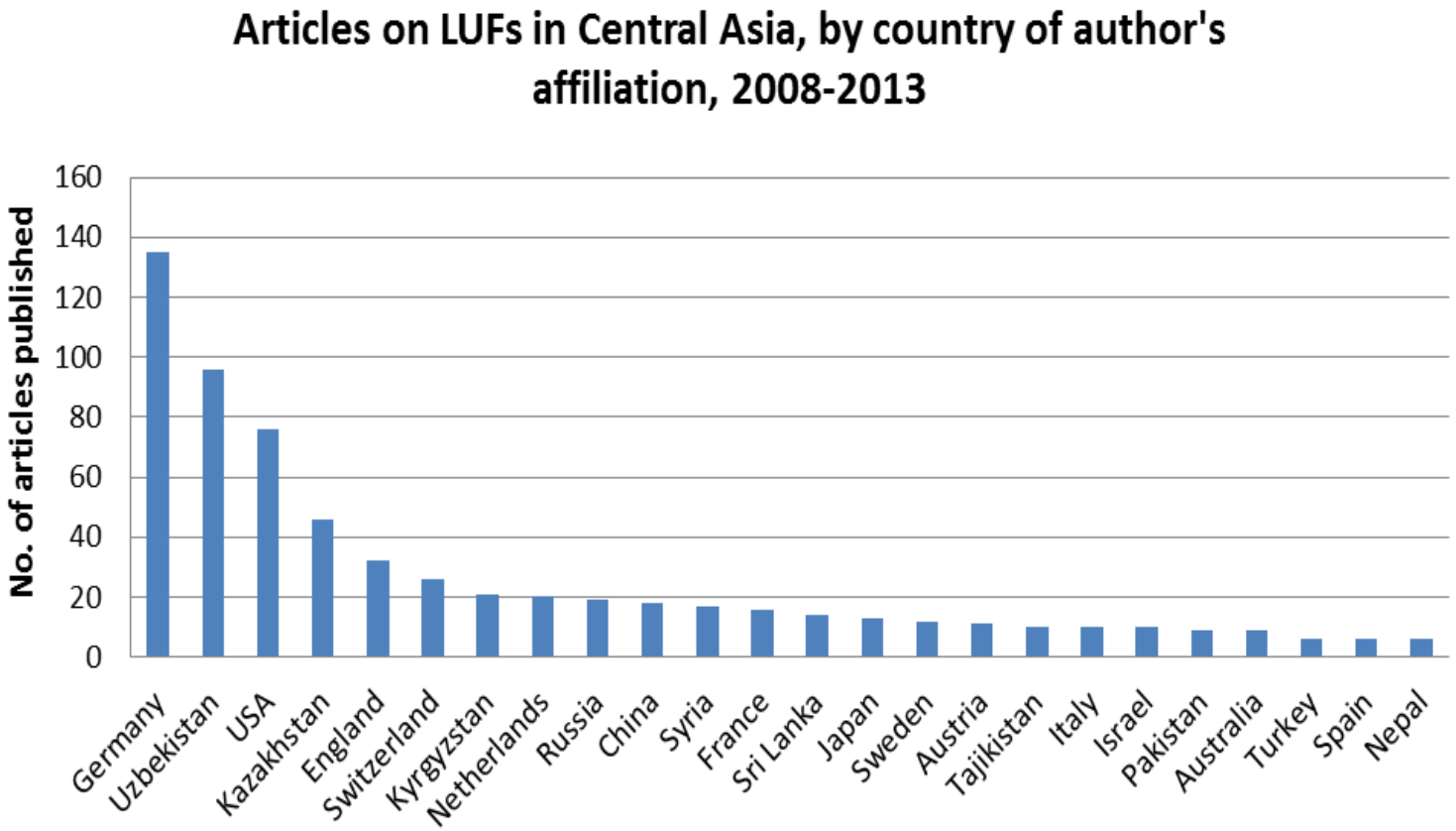
# Distribution of Land Use Functions



# Distribution across countries

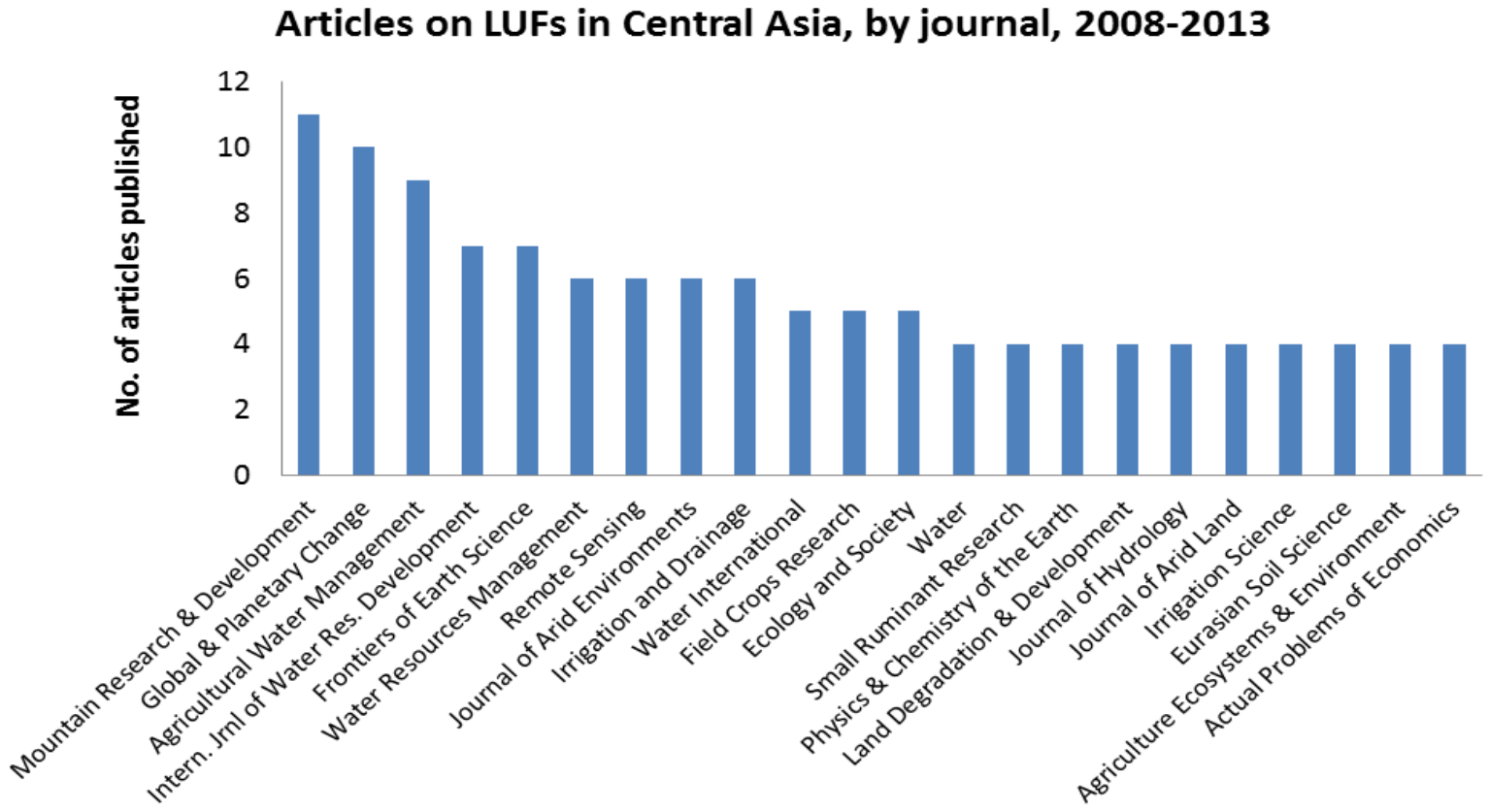


# Author affiliations



# Published journal types

- The 362 articles were published in 205 distinct journals



# 5. Conclusion

- The LUF framework does not make the decision
- Through applying the LUF framework, the study identified research focus and knowledge gaps in Central Asia that future scientists can contribute
- Comprehensive knowledge base is available concerning the impacts of agricultural land use on environmental issues
  - Physical and chemical properties of soil and water as well as maintenance of ecosystem processes
- Little information was available about the relationships between agricultural land use and biotic resources

# Going forward

- It would be interesting to identify local key stakeholders and policy makers and undertake participatory workshop to get their perspectives
- A mismatch between the research interests and the needs of key actors could further open up a new research interests
- Review of non-English and local Central Asian articles might also be of very high information level

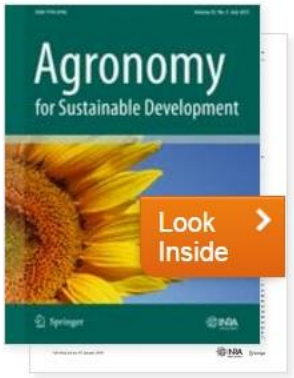
Review Article

Agronomy for Sustainable Development
March 2016, 36:6

First online: 07 January 2016

# Impact of agricultural land use in Central Asia: a review

Ahmad Hamidov , Katharina Helming, Dagmar Balla






## Abstract

Agriculture is major sector in the economy of Central Asia. The sustainable use of agricultural land is therefore essential to economic growth, human well-being, social equity, and ecosystem services. However, salinization, erosion, and desertification cause severe land degradation which, in turn,



You can download this paper at:
http://link.springer.com/article/10.1007/s13593-015-0337-7