Schedule for the summer school entitled "Global farmland abandonment: patterns, drivers and implications." July 3rd-July, 7th, 2023

Content: The world is facing a looming scarcity of land necessary to secure agricultural commodities production and experience competition from other land uses. At the same time, evidence suggests underuse and full farmland abandonment is a global land change process. It is Europe's most common land change process, with a recent spread of abandonment in the Global South. Farmland abandonment has strong implications for the environment and societal well-being, including food security. Abandoned lands in Europe and other parts of the world are now perceived as a source for environmental restoration and implications for carbon offsets as a part of the Green Transition, and opportunities for rewilding. Yet, to study abandonment is challenging from the definition of this process and methods applied to monitor abandonment and study the drivers and implications of farmland abandonment.

The scope of the Ph.D. course is to bring students and researchers who are interested in an interdisciplinary outlook on farmland abandonment from different angles of science. A critical point would be to assist students in selecting appropriate methods and data sets to study farmland abandonment. A set of lectures with a focus on the history of abandonment approaches to measure abandonment and empirical toolboxes to evaluate causal drivers of farmland abandonment will be presented. A special focus would be on the theoretical understanding of the farmland abandonment process, including behavioral mechanisms of farmland abandonment. The lectures will be complemented by discussions of key readings and several labs. We will also provide a space for students to present their preliminary results and give a space for fruitful constructive feedback.

Students will get comprehensive knowledge of the farmland abandonment process and methods to monitor and evaluate the drivers of farmland abandonment and the implications of socioeconomic and environmental processes. We expect that students will improve the design of their studies. Priority will be given first to those who conduct research on this topic.

Learning outcome:
- Obtained theoretical grounding on global land transitions and role or farmland abandonment;
- Gained experience in measuring farmland abandonment with statistics and satellite data;
- Evaluation of existing theories to study the drivers of farmland abandonment;
- Ability to develop the surveys to evaluate the drivers of farmland abandonment;
- Understanding the principles of econometrics, causal inference, and behavioral economics to study farmland abandonment;
- Knowledge of implications of farmland abandonment on environmental and socioeconomic processes and the role of telecoupling;
- Offered extra post-summer school ad-hoc feedback and assisted in the preparation of research manuscripts.

Skills:
- Critical literature evaluation on abandoned farmland;
- Applying econometric methods and elements of behavioral economics to study farmland abandonment;
- Able to select, process and classify satellite imagery to study farmland abandonment.

Competences:
- Knowledge of farmland abandonment topic and key literature
- Apply the models, theories and approaches to conduct research on farmland abandonment.

Teaching and Learning Methods:

The course will consist of lectures, seminars, and exercises. In seminars, students will discuss papers linked to lectures. During the exercises, students will get practical experience applying learned material during the lecture. We will also provide a space for students to present and discuss their preliminary results and we will give a space for fruitful constructive feedback.
Remarks.

Location: Geography section, Department of Geosciences and Natural Resources Management, University of Copenhagen, Øster Voldgade 10, 1350, Copenhagen

https://goo.gl/maps/HxuqRtL6qcpQw2Xu6

Auditoriums: Auditorium C (lectures), and Auditorium (Univ).8 for labs.

Floor plan: https://ign.ku.dk/kontakt/bygninger/oestervoldgade/etage0/

We will meet and greet you during the first day of summer school in front of the main entrance of the building and navigate you to Auditorium C (please be at the entrance by 08.45).

Questions and quick contacts about logistics or any other emerging topics: Hao Xia, hao@ign.ku.dk, tel. and Whatsapp + +4550136624. Alexander Prishchepov alpr@ign.ku.dk, tel. and Whatsapp +4560713122.

Course organizers and instructors:

Alexander Prishchepov (University of Copenhagen, alpr@ign.ku.dk), Simona Gradinaru (Swiss Federal Institute for Forest, Snow and Landscape Research-WSL, simona.gradinaru@wsl.ch), Miroslava Bavorova (Czech University of Life Sciences in Prague, bavorova@ftz.czu.cz), He Yin (Kent State University, hyin3@kent.edu), Torben Birch-Thomsen (the University of Copenhagen, tbt@ign.ku.dk).

Monday, July 3rd – Introduction. What is farmland abandonment? Theories and understanding socioeconomics behind farmland abandonment (all instructors, the lead- Simona and Alexander)	
09:00 – 10:30	**Session 1.** Getting to know each other. Course program and expectations (all instructors). Introduction to farmland abandonment in the context of global land transitions (Alexander).
10:30 - 10:50	Break
10:50 – 12:00	**Session 2. The reasoning behind farmland abandonment (Alexander and Simona).** • The concept of underlying and proximate causes of land-cover change. • The role of telecoupling. • Progress on studying the drivers of farmland abandonment and outlining research gaps. • Challenges arising from the various perspectives on (and definitions of) farmland abandonment.
12:00 – 13:30	Lunch break (we will provide sandwiches)
13:30 – 15:00	**Session 3. The use of a piece of land - Role play exercise (Simona and Alexander).** Summary: This role play is designed to engage students in a practical exercise regarding the use of land. Students will put on different hats to represent groups interested in leasing/purchasing the same piece of land (landowners, farmers, policymakers, nature-oriented NGO representatives, biofuel company owners, etc.) and will discuss the positive and negative aspects of land abandonment. Each group must present proposals to convince the landowner not to abandon the land but sell it or manage it according to the interest of the group they represent.
15:00 – 15:30	Break (activation activities)
15:30 – 17:00	**Session 4. Discussion about the essay on the topic of choice in a relationship on farmland abandonment.** Extra consultations. Summary by the end of the day.
Tuesday, July 4th – Typologies of farmland abandonment, abandonment in periurban areas (Simona). Surveying farmland abandonment with participatory socioeconomic approaches (Miroslava).	

09:00 – 10:30	**Session 1. Urban and peri-urban farmland abandonment I (Simona)** Topics covered (lecture) ● What makes this type of abandonment different? ● What are the drivers and connections to spatial/land-use planning? ● What is the interrelationship between urban sprawl and farmland abandonment? ● What happens with these abandoned lands in the short and long term? Insights from Bucharest (abandonment as a precursor of built-up development and the informal use of abandoned croplands for grazing).
10:30 - 10:50	Break
10:50 – 12:00	**Session 2. Urban and peri-urban land abandonment II (Simona)** Topic covered (short lecture - 20 min + 10 min discussions) ● Patterns of farmland abandonment in heterogeneous peri-urban landscapes. Exercise (60 min) ● Comparative analysis of peri-urban land abandonment in four study areas: ○ Abandonment of arable land - Bucharest, Romania. ○ Abandonment of olive tree orchards - Cieza, Spain. ○ Abandonment of cultivation terraces Portofino, Italy. ○ Abandonment of vineyards - Iasi, Romania.
12:00 – 13:30	Lunch break (we will provide sandwiches)
13:30 – 15:00	**Session 3. How to conduct a survey to indicate the factors affecting farmland abandonment? (Miroslava)** ● Develop the research problem statement and research gap and formulate the main objective in the context of studying drivers of farmland abandonment. ● Define the research study framework (theoretical framework, conceptual framework). ● Formulate research questions and hypotheses. ● Select the data analysis method. ● Operationalization of conceptual framework: define dependent and independent variables. ● Design questionnaire. ● Design sampling plan.
15:00 – 15:30	Break. Options to present your posters.

15:30 – 17:00	**Session 4. Examples of conducted surveys (Miroslava)** ● Farmland abandonment drivers in peri-urban Ghana (Miroslava). ● Farmland abandonment in Nigeria (experience of Oluwasey). ● Farmland abandonment and recultivation in Russia (Alexander and Miroslava).

Wednesday, July 5th – Field excursion day (Torben and Alexander)

9.00- Departure from the parking lot in front of the Geocenter (Øster Volgade 10).

Visiting several areas in northern and western Zeland (Sjælland). We will explore the transformation of agricultural lands to non-agricultural land uses in the vicinity of Copenhagen (horsification, conversion of former agricultural lands to hunting grounds). Then we will travel to visit Trundholm Mose to explore the ongoing withdrawal (retirement) of agricultural lands for environmental amenities and carbon offsets. Later, we will contrast the retired areas from farming and reduced land-use intensity with areas intensively cultivated (e.g., carrot production in Lammefjorden). On the way to study sites, we will prioritize visiting towns experiencing population growth but also population exodus.

The participants will be supplied with a small compendium of readings relevant to the field excursion.

During the field excursion, participants will be supplied with a lunch pack.

16.00- Expected arrival time to Copenhagen

Thursday, July 6th – Measuring farmland abandonment (He, additional assistance of Alexander)

09:00 – 10:30	**Session 1. Lecture: Measuring abandonment using remote sensing and other techniques (He) (no prior knowledge on remote sensing is required)** ● History of identifying abandonment. ● Abandonment mapping using satellite imagery. ● Other approaches to monitor farmland abandonment.
10:30 - 10:50	Break
10:50 – 12:00	**Session 2. Lecture: Google Earth Engine and farmland abandonment mapping using Landsat imagery (He)** ● Brief introduction to Google Earth Engine. ● Basic remote sensing knowledge. ● Landsat imagery and analysis.

	● Annual cropland mapping. ● Abandonment mapping. ● Accuracy assessment.
12:00 – 13:30	Lunch break (we will provide sandwiches)
13:30 – 15:00	**Session 3. Exercise: Mapping farmland abandonment using Google Earth Engine (He)** ● Using Google Earth Engine to map abandonment in selected sites; the site can be selected from a literature review or suggested by instructors
15:00 – 15:30	Break (activation activities)
15:30 – 17:00	**Session 4. Presentations from the students on their exercise (He and all)** ● Presentation of each student to report their abandonment maps (5 mins presentation + 3 mins Q&A)
Friday, July 7th – Implications of farmland abandonment to food security, environment and policies.	
09:00 – 10:30	**Session 1. How to feed the world in 2050? (Miroslava)** ● Sources of production growth in agriculture ○ Expansion of land area ○ Expansion of harvested area ■ Environmental problems/ land degradation; water scarcity ○ Technological progress ○ Availability of resources ● What can policies do?
10:30 - 10:50	Short break
10:50 – 12:00	**Session 2. The consequences of abandonment (Alexander+He)** ● Implications of abandonment on biodiversity ● Implications of abandonment of carbon sequestration
12:00 – 13:30	Lunch break (we will provide sandwiches)

13:30 – 17:00	Session 3. Q&A, any consultations

Evaluation and grading.

The lectures will be complemented by active discussions. Thus, active participation in the class is strongly encouraged and we expect you to pass through the readings listed below. You are more than welcome to bring your case studies, and you are more than welcome to present your work or bring the posters. We will have time to actively discuss and provide feedback. The evaluation of the course will be based on a written essay of up to 15 pages, submitted no later than two weeks after the course (pass/ fail). If you need a mark, please let us know. We will discuss the essay during the first day of the class. We also offer an option to jointly prepare an opinion paper on farmland abandonment, and we will aim at one of the journals, such as the Journal of Land Use Science. We will discuss that in class too.

Associated readings.

Pdfs are here https://drive.google.com/drive/folders/1IlcOFU0FX-ntYYERMF9IIgJBrEGnbptd?usp=sharing

Monday, July 3rd

Session 1. Introduction to farmland abandonment in the context of global land transitions. Global land cover change, the discourse on definitions of farmland abandonment. Historical and modern aspects of farmland abandonment.

Prishchepov, Alexander V. "Agricultural Land Abandonment." In *Environmental Science*, by Alexander V. Prishchepov. Oxford University Press, 2020. https://doi.org/10.1093/obo/9780199363445-0129.

- *Encyclopedia-like article on agricultural land abandonment with suggested readings.*

Grădinaru, Simona R., Cristian I. Iojă, Gabriel Ovidiu Vânău, and Diana Andreea Onose. "Multi-Dimensionality of Land Transformations: From Definition to Perspectives on Land Abandonment." *Carpathian Journal of Earth and Environmental Sciences* 15, no. 1 (February 2020): 167–77. https://doi.org/10.26471/cjees/2020/015/119

- *A paper specifically looks at the complexity of farmland abandonment definition from semantics, legislative, botany and remote sensing perspectives.*

Holl et al.,2022. "Redefining "abandoned" agricultural land in the context of reforestation." Frontiers in Forests and Global Change 6. https://doi.org/10.3389/ffgc.2022.933887.

- *A new conceptualization of abandoned agricultural land that incorporates changes in landholding status over time into determining whether land is abandoned or not.*

Session 2. The reasoning behind farmland abandonment. The concept of underlying and proximate causes. The role of telecoupling. The progress on studying the drivers of farmland abandonment and outlining research gaps.

Meyfroidt, Patrick. “Approaches and Terminology for Causal Analysis in Land Systems Science.” Journal of Land Use Science, December 21, 2015, 1–22. https://doi.org/10.1080/1747423X.2015.1117530 .

- *Terminology used in land system science*

Geist, H. J., and E. F. Lambin. “Proximate Causes and Underlying Driving Forces of Tropical Deforestation.” Bioscience 52, no. 2 (2002): 143–50.

- *A conceptual framework for understanding interlinkages between proximate and causal drivers of landscape change.*

Subedi, Yuba Raj, Paul Kristiansen, and Oscar Cacho. “Drivers and Consequences of Agricultural Land Abandonment and Its Reutilisation Pathways: A Systematic Review.” Environmental Development, November 2021, 100681. https://doi.org/10.1016/j.envdev.2021.100681 .

- *A systematic review of the drivers of farmland abandonment, also both positive and negative implications of farmland abandonment. Attention is paid to revisiting the reuse of abandoned farmlands.*

Schierhorn, Florian, Thomas Kastner, Tobias Kuemmerle, Patrick Meyfroidt, Irina Kurganova, Alexander V Prishchepov, Karl-Heinz Erb, Richard A Houghton, and Daniel Müller. “Large Greenhouse Gas Savings Due to Changes in the Post-Soviet Food Systems.” Environmental Research Letters 14, no. 6 (June 20, 2019): 065009. https://doi.org/10.1088/1748-9326/ab1cf1 .

- *How land use change and changing diets shape the production and carbon emissions via telecoupling*

Tuesday, July 4th

Sessions 1 and 2 Urban and peri-urban land abandonment I

Grădinaru, S. R., Iojă, C. I., Onose, D. A., Gavrilidis, A. A., Pătru-Stupariu, I., Kienast, F., & Hersperger, A. M. (2015). Land abandonment as a precursor of built-up development at the sprawling periphery of former socialist cities. *Ecological Indicators*, *57*, 305-313

- *Example of study on periurban transformation, including farmland abandonment*

Fayet, C. M., Reilly, K. H., Van Ham, C., & Verburg, P. H. (2022). What is the future of abandoned agricultural lands? A systematic review of alternative trajectories in Europe. *Land use policy*, *112*, 105833.

- *Perspectives for abandoned and cultivated lands following the debates including rewilding and Green Deal.*

Session 4. Examples of conducted surveys

Grinfelde, Inga, and Mathijs, Erik. “Agricultural Land Abandonment in Latvia: An Econometric Analysis of Farmers’ Choice.” *Agricultural Economics Society Annual Conference, Imperial College, South Kensington*, London, January 1, 2004. https://doi.org/10.5281/ZENODO.6798669 .

- *An example of farm survey and establishment of the causal framework to evaluate the factors affecting farmland abandonment.*

Prishchepov, Alexander V., Elena V. Ponkina, Zhanli Sun, Miroslava Bavorova, and Olga A. Yekimovskaja. "Revealing the Intentions of Farmers to Recultivate Abandoned Farmland: A Case Study of the Buryat Republic in Russia." *Land Use Policy* 107 (August 2021): 105513. https://doi.org/10.1016/j.landusepol.2021.105513 .

- *An example of survey of farmers and evaluation of behavioral mechanisms, plus, the establishment of the causal framework.*

Thursday, July 6th

Session 1 and 2. Measuring abandonment

Yin et al., 2020. Monitoring cropland abandonment with Landsat time series. Remote Sensing of Environment 246: 111873 DOI: 10.1016/j.rse.2020.111873

- *This study is the first one that tries to map abandonment and recultivation across different environments and agricultural systems around the globe using long-term Landsat time series*

Lesiv et al., 2018. Spatial distribution of arable and abandoned land across former Soviet Union countries. Scientific Data 5: 180056. DOI: 10.1038/sdata.2018.56

- *Large scale abandonment mapping based on existing land cover products*

Goga et al., 2019. A Review of the Application of Remote Sensing Data for Abandoned Agricultural Land Identification with Focus on Central and Eastern Europe. Remote Sensing. 11: 2759. DOI: 10.3390/rs11232759

- *A review of using remote sensing technique to map abandonment in Eastern Europe.*

Friday, July 7th

Session 1

Please revisit Fayet, C. M., Reilly, K. H., Van Ham, C., & Verburg, P. H. (2022). What is the future of abandoned agricultural lands? A systematic review of alternative trajectories in Europe. Land use policy, 112, 105833.

- *Perspectives for abandoned and cultivated lands following the debates including rewilding and Green Deal.*

Meyfroidt, Patrick, F. Schierhorn, A. V. Prishchepov, D. Müller, and T. Kuemmerle. "Drivers, Constraints and Trade-Offs Associated with Recultivating Abandoned Cropland in Russia, Ukraine and Kazakhstan." *Global Environmental Change* 37 (2016): 1–15. https://doi.org/10.1016/j.gloenvcha.2016.01.003 .

- *"Limited" availability of abandoned lands to satisfy growing food demand*

Session 2

Crawford et al., 2022. Rural land abandonment is too ephemeral to provide major benefits for biodiversity and climate" Science Advances. 8: eabm8999. DOI: 10.1126/sciadv.abm8999

- *This study showed that abandonment is more fleeting than people thought. The frequent re-cultivation hampers the full potential of abandoned croplands for conservation and carbon sequestration.*

Bell et al., 2023. Quantifying the recarbonization of post-agricultural landscapes. Nature Communications. 14: 2139. DOI: 10.1038/s41467-023-37907-w

- *Latest comments on the potential of abandoned lands for carbon storage*

Queiroz, Cibele, Ruth Beilin, Carl Folke, and Regina Lindborg. 2014 "Farmland Abandonment: Threat or Opportunity for Biodiversity Conservation? A Global Review." 12: 288–96. *https://doi.org/10.1890/120348*.

- *A global overview of farmland abandonment looks at the biodiversity part of this process.*