UNU Institute for the Advanced Study of Sustainability (UNU-IAS)
Autum 2018 Autum Semester Course

As of June 20, 2018

Title of Course: Resilience and Adaptation Science (RAS)

Coordinators: Dr. Riyanti Djalante
Course Schedule: From 2 Oct. until 13 Dec. 2018

Purpose and learning outcomes: This course will cover a range of issues on the science and impacts of climate change, adaptation and mitigation to climate change, governance and climate resilience. Topics include climate and atmospheric science, hazard, risks, vulnerability and resilience assessment, impacts of climate change on the environment and in different sectors, adaptation and mitigation to climate change, governance of climate change from theories to implementations.

Course Outline

Lecture	Date	Content	Instructor
Lecture 1	2 Oct, 11:00-12:30	Introduction of the course Climate Change Science	Dr. Riyanti Djalante
		Assignment 1 (Lecture 1 to 14): Class summary, due 1 day after lecture	
		Assignment 2: Annotated bibliography (Lecture 1 to 14), due 2 days after lecture	
Lecture 2	2 Oct, 14:00-15:30	Climate Change Impacts: Air, Land, Biota, Water, Ocean	Dr. Riyanti Djalante
Lecture 3	3 Oct , 11:00-12:30	Key concepts: hazards, vulnerability, risks,	Dr. Riyanti Djalante
Lecture 4	4 Oct , 11:00-12:30	Key concepts: adaptive capacity, resilience and transformation	Dr. Riyanti Djalante
Lecture 5	30 Oct , 11:00-12:30	The social impacts of climate change: livelihood and poverty, inequality, gender	Dr. Riyanti Djalante
Lecture 6	30 Oct, 14:00-15:30	The social impacts of climate change: migration, displacement, conflicts	Dr. Riyanti Djalante
Lecture 7	1 Nov, 11:00-12:30	Key concepts in climate change adaptation	Dr. Riyanti Djalante
Lecture 8	13 Nov, 11:00-12:30	Integration of climate change adaptation and disaster risk reduction	Dr. Riyanti Djalante
Lecture 9	15 Nov, 11:00-12:30	Climate change impacts, adaptation in different sectors: water, health and agriculture sector	Dr. Riyanti Djalante
Lecture 10	20 Nov, 11:00-12:30	Climate change impacts, adaptation in different sectors: forestry, ecosystem-based, and community-based adaptation	Dr. Riyanti Djalante
Lecture 11	22 Nov, 11:00-12:30	Climate change finance and insurance	Dr. Riyanti Djalante

Lecture	Date	Content	Instructor
	23 Nov. (Fri), 5pm	Assignment 3: Research paper due	Dr. Riyanti Djalante
Lecture 12	27 Nov, 11:00-12:30	Governance of climate change	Dr. Riyanti Djalante
Lecture 13	29 Nov, 11:00-12:30	Climate change mitigation: Key policies and progresses	Dr. Riyanti Djalante
Lecture 14	4 Dec, 11:00-12:30	Climate change mitigation at different sectors	Dr. Riyanti Djalante
Lecture 15	6 Dec, 11:00-12:30	Assignment 5: Class Presentation	Dr. Riyanti Djalante
	7 Dec, 23.55pm	Assignment 4: Critical review due	Dr. Riyanti Djalante

Assessments:

- Attendance and class participation: 2%
- Assignment 1: Class summary
    - 14x1%=14%
    - Write a summary of lecture (Lecture 1 to 14)
        - Summary of lecture
        - Most interesting/important topic you learnt
        - particular discussion that you are still unclear of
    - 200word (in 1 page only), Arial 12, 1.5 space
    - Key discussion
    - **Course name, lecture topic name, students' name and number are in the header.**
- Assignment 2: Annotated bibliography
    - 14x1%=14%
    - Write an annotated bibliography on key topics discussed in the lecture (from Lecture 1 to 14)
    - 4 References @ 50-75words (journal articles only)
    - 1 page, Arial 12, 1.5 space,
    - Harvard referencing style
    - **Course name, lecture topic name, students' name and number are in the header.**

- Assignment 3: Research paper of impacts of climate change on particular country's and how the impacts have been managed
    - 20% of total marks
    - Key topics to review:
        - Choose a particular region or country
        - Discuss the impacts of climate change impacts
        - Outline the progress of climate change adaptation and mitigation
        - Describe the climate governance at different level.
        - How you think the management and governance can be improved
    - 1500 words, Arial 12, 1.5 space, double side, cover page, references (min 10 journal articles, and reports), Harvard referencing style

- Assignment 4: Critical review of climate change management at different sector
    - 40% of total marks
    - Key topics to review and critique:
        - Choose a particular development sector (include but not limited to fisheries, agriculture, disaster management, gender empowerment, etc)
        - Discuss the impacts of climate change impacts on that particular sector (globally and regionally)
        - Outline the finances available to deal with the impacts, discuss whether this is sufficient or not, and why
        - Describe and critique progress in planning and implementation (globally and regionally) (adaptation and mitigation if appropriate)
        - Discuss whether the planning and implementation has been able to reduce the the underlying causes vulnerability of particular places/targets, reduce poverty and address inequality
    - 2500 words, Arial 12, 1.5 space, double side, cover page, references (min 20 journal articles, and reports)
    - Harvard referencing style

- Assignment 5: Class Presentation
    - 10% of total marks
    - 5 minute presentation,
    - Maximum 5 slides
        - 1 on discussion of the impacts of climate change on that particular sector (globally and regionally), (adaptation and mitigation)
        - 1 on review of finances and progress in planning and implementation
        - 1 on your critique on planning and implementation
        - 2 on your critique on whether they have addressed the underlying causes vulnerability, reduce poverty and address inequality, and in the pathway of low-carbon development

Text books and reading materials:

REQUIRED READING

Lecture	Content	Required (in bold) and recommended readings
Lecture 1	Introduction of the course	
	Climate Change Science	**1. Pachauri, Rajendra K., et al. *Climate change 2014: synthesis report. Contribution of Working Groups I to the fifth assessment report of the Intergovernmental Panel on Climate Change*. IPCC, 2014.** 2. Moss, R. H., Edmonds, J. A., Hibbard, K. A., Manning, M. R., Rose, S. K., Van Vuuren, D. P., ... & Meehl, G. A. (2010). The next generation of scenarios for climate change research and assessment. *Nature*, *463*(7282), 747. 3. Moss, Richard H., Jae A. Edmonds, Kathy A. Hibbard, Martin R. Manning, Steven K. Rose, Detlef P. Van Vuuren, Timothy R. Carter et al. "The next generation of scenarios for climate change research and assessment." *Nature* 463, no. 7282 (2010): 747.
Lecture 2	Climate Change Impacts: Air, Land, Biota, Water, Ocean	**1. Pachauri, Rajendra K., et al. *Climate change 2014: synthesis report. Contribution of Working Groups II to the fifth assessment report of the Intergovernmental Panel on Climate Change*. IPCC, 2014.** 2. Scheffer, M., Carpenter, S., Foley, J. A., Folke, C., & Walker, B. (2001). Catastrophic shifts in ecosystems. *Nature*, *413*(6856), 591. 3. Walther, Gian-Reto, Eric Post, Peter Convey, Annette Menzel, Camille Parmesan, Trevor JC Beebee, Jean-Marc Fromentin, Ove Hoegh-Guldberg, and Franz Bairlein. "Ecological responses to recent climate change." *Nature* 416, no. 6879 (2002): 389. 4. Parmesan, C., & Yohe, G. (2003). A globally coherent fingerprint of climate change impacts across natural systems. *Nature*, *421*(6918), 37. 5. Allen, C. D., Macalady, A. K., Chenchouni, H., Bachelet, D., Hughes, T. P., Baird, A. H., Bellwood, D. R., Card, M., Connolly, S. R., Folke, C., ... & Lough, J. M. (2003). Climate change, human impacts, and the resilience of coral reefs. *science*, *301*(5635), 929-933. 6. Shrestha, U. B., Gautam, S., & Bawa, K. S. (2012). Widespread climate change in the Himalayas and associated changes in local ecosystems. *PLoS One*, *7*(5), e36741. 7. Kelly, A. E., & Goulden, M. L. (2008). Rapid shifts in plant distribution with recent climate change. *Proceedings of the National Academy of Sciences*, *105*(33), 11823-11826. 8. McDowell, N., Vennetier, M., ... & Gonzalez, P. (2010). A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests. *Forest ecology and management*, *259*(4), 660-684.
Lecture 3	Key concepts: hazards, vulnerability, risks,	**1. Gallopín, Gilberto C. "Linkages between vulnerability, resilience, and adaptive capacity." *Global environmental change* 16.3 (2006): 293-303.** **2. Smit, Barry, and Johanna Wandel. "Adaptation, adaptive capacity and vulnerability." *Global environmental change* 16.3 (2006): 282-292.** 3. Turner, Billie L., et al. "A framework for vulnerability analysis in sustainability science." *Proceedings of the national academy of*

Lecture	Content	Required (in bold) and recommended readings
		sciences 100.14 (2003): 8074-8079. 4. Birkmann, Joern, et al. "Framing vulnerability, risk and societal responses: the MOVE framework." *Natural hazards* 67.2 (2013): 193-211. 5. Füssel, H. M., & Klein, R. J. (2006). Climate change vulnerability assessments: an evolution of conceptual thinking. *Climatic change*, *75*(3), 301-329. 6. Füssel, H. M. (2007). Vulnerability: A generally applicable conceptual framework for climate change research. *Global environmental change*, *17*(2), 155-167. 7. Kelly, P. M., & Adger, W. N. (2000). Theory and practice in assessing vulnerability to climate change and Facilitating adaptation. *Climatic change*, *47*(4), 325-352. 8. O'BRIEN, K. A. R. E. N., Eriksen, S., Nygaard, L. P., & Schjolden, A. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate policy*, *7*(1), 73-88. 9. Birkmann, Jorn. "Indicators and criteria for measuring vulnerability: Theoretical bases and requirements." *Measuring vulnerability to natural hazards: Towards disaster resilient societies* (2006): 55-77. 10. Birkmann, Joern. "Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications." *Environmental hazards* 7.1 (2007): 20-31.
Lecture 4	Key concepts: adaptive capacity, resilience and transformation	**1. Adger, W. N., Hughes, T. P., Folke, C., Carpenter, S. R., & Rockström, J. (2005). Social-ecological resilience to coastal disasters. *Science*, *309*(5737), 1036-1039.** **2. Klein, Richard JT, Robert J. Nicholls, and Frank Thomalla. "Resilience to natural hazards: How useful is this concept?." *Global Environmental Change Part B: Environmental Hazards* 5.1 (2003): 35-45.** **3. O'Brien, K. (2012). Global environmental change II: from adaptation to deliberate transformation. *Progress in Human Geography*, *36*(5), 667-676.** 4. Pelling, M., O'Brien, K., & Matyas, D. (2015). Adaptation and transformation. *Climatic Change*, *133*(1), 113-127. 5. Miller, Fiona, et al. "Resilience and vulnerability: complementary or conflicting concepts?." *Ecology and Society* 15.3 (2010). 6. Folke, Carl, et al. "Resilience and sustainable development: building adaptive capacity in a world of transformations." *AMBIO: A journal of the human environment* 31.5 (2002): 437-440. 7. Alexander, David E. "Resilience and disaster risk reduction: an etymological journey." *Natural hazards and earth system sciences* 13.11 (2013): 2707-2716. 8. Walker, Brian, et al. "Resilience, adaptability and transformability in social–ecological systems." *Ecology and society* 9.2 (2004). 9. Park, S. E., Marshall, N. A., Jakku, E., Dowd, A. M., Howden, S. M., Mendham, E., & Fleming, A. (2012). Informing adaptation responses to climate change through theories of transformation. *Global Environmental Change*, *22*(1), 115-126. 10. Wise, R. M., Fazey, I., Smith, M. S., Park, S. E., Eakin, H. C., Van Garderen,

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		E. A., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change*, *28*, 325-336. 11. Kates, R. W., Travis, W. R., & Wilbanks, T. J. (2012). Transformational adaptation when incremental adaptations to climate change are insufficient. *Proceedings of the National Academy of Sciences*, *109*(19), 7156-7161. 12. Thomalla, Frank, Michael Boyland, Karlee Johnson, Jonathan Ensor, Heidi Tuhkanen, Åsa Gerger Swartling, Guoyi Han, John Forrester, and Darin Wahl. "Transforming development and disaster risk." *Sustainability* (2018).
Lecture 5	The social impacts of climate change: livelihood and poverty, inequality, gender	**1. Winsemius, H. C., Jongman, B., Veldkamp, T. I., Hallegatte, S., Bangalore, M., & Ward, P. J. (2018). Disaster risk, climate change, and poverty: assessing the global exposure of poor people to floods and droughts. *Environment and Development Economics*, 1-21.** **2. King, A. D., & Harrington, L. J. (2018). The Inequality of Climate Change from 1.5° C to 2° C of Global Warming. *Geophysical Research Letters*.** **3. Byers, Edward, Matthew Gidden, David Leclère, Juraj Balkovic, Peter Burek, Kristie Ebi, Peter Greve et al. "Global exposure and vulnerability to multi-sector development and climate change hotspots." *Environmental Research Letters* 13, no. 5 (2018): 055012.** 4. Tanner, Thomas, David Lewis, David Wrathall, Robin Bronen, Nick Cradock-Henry, Saleemul Huq, Chris Lawless et al. "Livelihood resilience in the face of climate change." *Nature Climate Change* 5, no. 1 (2015): 23. 5. Reyer, Christopher PO, Kanta Kumari Rigaud, Erick Fernandes, William Hare, Olivia Serdeczny, and Hans Joachim Schellnhuber. "Turn down the heat: regional climate change impacts on development." (2017): 1563-1568. 6. Kaijser, A., & Kronsell, A. (2014). Climate change through the lens of intersectionality. *Environmental politics*, *23*(3), 417-433. 7. Otto, I. M., Reckien, D., Reyer, C. P., Marcus, R., Le Masson, V., Jones, L., ... & Serdeczny, O. (2017). Social vulnerability to climate change: a review of concepts and evidence. *Regional environmental change*, *17*(6), 1651-1662. 8. Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Narloch, U., Rozenberg, J., & Vogt-Schilb, A. (2014). Climate change and poverty--an analytical framework. 9. Agrawal, A., & Perrin, N. (2009). Climate adaptation, local institutions and rural livelihoods. *Adapting to climate change: thresholds, values, governance*, 350-367. 10. Carr, E. R., & Thompson, M. C. (2014). Gender and climate change adaptation in agrarian settings: Current thinking, new directions, and research frontiers. *Geography Compass*, *8*(3), 182-197. 11. Alston, M. (2014, November). Gender mainstreaming and climate change. In *Women's Studies International Forum* (Vol. 47, pp. 287-294). Pergamon. 12. Bryan, E., Bernier, Q., Espinal, M., & Ringler, C. (2017). Making climate change adaptation programmes in sub-Saharan Africa more gender responsive: insights from implementing organizations on the barriers and

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		opportunities. *Climate and Development*, 1-15. 13. Gaard, G. (2015, March). Ecofeminism and climate change. In *Women's Studies International Forum* (Vol. 49, pp. 20-33). Pergamon. 14. Bolt, B., Nes, E. H., Bathiany, S., Vollebregt, M. E., & Scheffer, M. (2018). Climate reddening increases the chance of critical transitions. *Nature Climate Change*, *8*(6), 478. 15. Eastin, J. (2018). Climate change and gender equality in developing states. *World Development*, *107*, 289-305. 16. Sultana, F. (2014). Gendering climate change: Geographical insights. *The Professional Geographer*, *66*(3), 372-381. 17. Moosa, C. S., & Tuana, N. (2014). Mapping a research agenda concerning gender and climate change: A review of the literature. *Hypatia*, *29*(3), 677-694. 18. Jerneck, Anne. "What about Gender in Climate Change? Twelve Feminist Lessons from Development." *Sustainability*10.3 (2018): 627. 19. Cameron, E. S. (2012). Securing Indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. *Global environmental change*, *22*(1), 103-114. 20. Green, D., & Raygorodetsky, G. (2010). Indigenous knowledge of a changing climate. *Climatic Change*, *100*(2), 239-242. 21. Alexander, Clarence, Nora Bynum, Elizabeth Johnson, Ursula King, Tero Mustonen, Peter Neofotis, Noel Oettlé et al. "Linking indigenous and scientific knowledge of climate change." *BioScience* 61, no. 6 (2011): 477-484. 22. Klinsky, Sonja, Timmons Roberts, Saleemul Huq, Chukwumerije Okereke, Peter Newell, Peter Dauvergne, Karen O'Brien et al. "Why equity is fundamental in climate change policy research." *Global Environmental Change* 44 (2017): 170-173.
Lecture 6	The social impacts of climate change: migration, displacement, conflicts	**1. Barnett, J., & Adger, W. N. (2007). Climate change, human security and violent conflict. *Political geography*, *26*(6), 639-655.** **2. McLeman, R., & Smit, B. (2006). Migration as an adaptation to climate change. *Climatic change*, *76*(1-2), 31-53.** **3. Reuveny, R. (2007). Climate change-induced migration and violent conflict. *Political geography*, *26*(6), 656-673.** 4. Black, Richard, et al. "The effect of environmental change on human migration." *Global environmental change* 21 (2011): S3-S11. 5. Tacoli, C. (2009). Crisis or adaptation? Migration and climate change in a context of high mobility. *Environment and urbanization*, *21*(2), 513-525. 6. Black, R., Adger, W. N., Arnell, N. W., Dercon, S., Geddes, A., & Thomas, D. (2011). The effect of environmental change on human migration. *Global environmental change*, *21*, S3-S11. 7. McLachlan, J. S., Hellmann, J. J., & Schwartz, M. W. (2007). A framework for debate of assisted migration in an era of climate change. *Conservation biology*, *21*(2), 297-302. 8. Raleigh, C., & Urdal, H. (2007). Climate change, environmental degradation and armed conflict. *Political geography*, *26*(6), 674-694.

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		9. Hendrix, C. S., & Glaser, S. M. (2007). Trends and triggers: Climate, climate change and civil conflict in Sub-Saharan Africa. *Political geography*, *26*(6), 695-715. 10. Kelley, C. P., Mohtadi, S., Cane, M. A., Seager, R., & Kushnir, Y. (2015). Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proceedings of the National Academy of Sciences*, *112*(11), 3241-3246. 11. Beck, U. (2015). Emancipatory catastrophism: What does it mean to climate change and risk society?. *Current Sociology*, *63*(1), 75-88. 12. Schleussner, C. F., Donges, J. F., Donner, R. V., & Schellnhuber, H. J. (2016). Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries. *Proceedings of the National Academy of Sciences*, *113*(33), 9216-9221.
Lecture 7	Key concepts in climate change adaptation	**1. Füssel, H-M. "Adaptation planning for climate change: concepts, assessment approaches, and key lessons." *Sustainability science* 2.2 (2007): 265-275.** **2. Huq, Saleemul, et al. "Mainstreaming adaptation to climate change in least developed countries (LDCs)." *Climate Policy* 4.1 (2004): 25-43.** **3. Adger, W. Neil, Nigel W. Arnell, and Emma L. Tompkins. "Successful adaptation to climate change across scales." *Global environmental change*15.2 (2005): 77-86.** **4. Davoudi, S., Shaw, K., Haider, L. J., Quinlan, A. E., Peterson, G. D., Wilkinson, C., ... & Davoudi, S. (2012). Resilience: a bridging concept or a dead end?"Reframing" resilience: challenges for planning theory and practice interacting traps: resilience assessment of a pasture management system in Northern Afghanistan urban resilience: what does it mean in planning practice? Resilience as a useful concept for climate change adaptation? The politics of resilience for planning: a cautionary note: edited by Simin Davoudi and Libby Porter. *Planning theory & practice*, *13*(2), 299-333.** 5. Adger, W. Neil, et al. "Adaptation to climate change in the developing world." *Progress in development studies* 3.3 (2003): 179-195. 6. Adger, W. N. (2003). Social capital, collective action, and adaptation to climate change. *Economic geography*, *79*(4), 387-404. 7. Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., ... & Wreford, A. (2009). Are there social limits to adaptation to climate change?. *Climatic change*, *93*(3-4), 335-354. 8. Adger, W. N., Quinn, T., Lorenzoni, I., Murphy, C., & Sweeney, J. (2013). Changing social contracts in climate-change adaptation. *Nature Climate Change*, *3*(4), 330. 9. Fankhauser, Samuel, Joel B. Smith, and Richard SJ Tol. "Weathering climate change: some simple rules to guide adaptation decisions." *Ecological economics* 30.1 (1999): 67-78. 10. Tang, Zhenghong, et al. "Moving from agenda to action: evaluating local climate change action plans." *Journal of environmental planning and management* 53.1 (2010): 41-62. 11. Füssel, H. M. (2007). Adaptation planning for climate change: concepts,

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		assessment approaches, and key lessons. *Sustainability science*, *2*(2), 265-275. 12. Davoudi, S., Crawford, J., & Mehmood, A. (Eds.). (2009). *Planning for climate change: strategies for mitigation and adaptation for spatial planners*. Routledge. 13. Howard, J. (2009). Climate change mitigation and adaptation in developed nations: A critical perspective on the adaptation turn in urban climate planning. In *Planning for Climate Change*(pp. 43-56). Routledge. 14. Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global environmental change*, *15*(2), 77-86. 15. Measham, T. G., Preston, B. L., Smith, T. F., Brooke, C., Gorddard, R., Withycombe, G., & Morrison, C. (2011). Adapting to climate change through local municipal planning: barriers and challenges. *Mitigation and adaptation strategies for global change*, *16*(8), 889-909. 16. Wamsler, C., Brink, E., & Rivera, C. (2013). Planning for climate change in urban areas: from theory to practice. *Journal of Cleaner Production*, *50*, 68-81. 17. Rosenzweig, Cynthia, et al. "Cities lead the way in climate-change action." *Nature* 467.7318 (2010): 909-911. 18. Eriksen, S. H., Nightingale, A. J., & Eakin, H. (2015). Reframing adaptation: The political nature of climate change adaptation. *Global Environmental Change*, *35*, 523-533. 19. Adger, W. Neil, Suraje Dessai, Marisa Goulden, Mike Hulme, Irene Lorenzoni, Donald R. Nelson, Lars Otto Naess, Johanna Wolf, and Anita Wreford. "Are there social limits to adaptation to climate change?." *Climatic change* 93, no. 3-4 (2009): 335-354.
Lecture 8	Integration of climate change adaptation and disaster risk reduction	**1. IPCC, 2012: Summary for Policymakers. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 1-19.** **2. UNISDR 2015 Sendai Framework for Disaster Risk Reduction 2015-2030** **3. Schipper, Lisa, and Mark Pelling. "Disaster risk, climate change and international development: scope for, and challenges to, integration." *Disasters* 30.1 (2006): 19-38.** 4. Thomalla, Frank, et al. "Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation." *Disasters*30.1 (2006): 39-48.
Lecture 9	Climate change impacts, adaptation	**1. Lobell, D. B., Burke, M. B., Tebaldi, C., Mastrandrea, M. D., Falcon, W. P., & Naylor, R. L. (2008). Prioritizing climate change adaptation needs for food security in 2030. *Science*, *319*(5863), 607-610.** 2. Haines, Andy, et al. "Climate change and human health: impacts,

Lecture	Content	Required (in bold) and recommended readings
	and mitigation in different sectors: water, health and agriculture sector	vulnerability and public health." *Public health* 120.7 (2006): 585-596. 3. Patz, J. A., Campbell-Lendrum, D., Holloway, T., & Foley, J. A. (2005). Impact of regional climate change on human health. *Nature*, *438*(7066), 310. 4. Watts, Nick, W. Neil Adger, Paolo Agnolucci, Jason Blackstock, Peter Byass, Wenjia Cai, Sarah Chaytor et al. "Health and climate change: policy responses to protect public health." *The Lancet* 386, no. 10006 (2015): 1861-1914. **5. Vörösmarty, Charles J., et al. "Global water resources: vulnerability from climate change and population growth." *science* 289.5477 (2000): 284-288.** 6. Haines, A., Kovats, R. S., Campbell-Lendrum, D., & Corvalán, C. (2006). Climate change and human health: impacts, vulnerability and public health. *Public health*, *120*(7), 585-596.Alcamo, Joseph, Martina Flörke, and Michael Märker. "Future long-term changes in global water resources driven by socio-economic and climatic changes." *Hydrological Sciences Journal* 52.2 (2007): 247-275. 7. Immerzeel, W. W., Van Beek, L. P., & Bierkens, M. F. (2010). Climate change will affect the Asian water towers. *Science*, *328*(5984), 1382-1385. 8. Taylor, Richard G., Bridget Scanlon, Petra Döll, Matt Rodell, Rens Van Beek, Yoshihide Wada, Laurent Longuevergne et al. "Ground water and climate change." *Nature Climate Change*3, no. 4 (2013): 322. 9. Kelley, C. P., Mohtadi, S., Cane, M. A., Seager, R., & Kushnir, Y. (2015). Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proceedings of the National Academy of Sciences*, *112*(11), 3241-3246. 10. Smit, Barry, and Mark W. Skinner. "Adaptation options in agriculture to climate change: a typology." *Mitigation and adaptation strategies for global change* 7.1 (2002): 85-114. 11. Howden, S. M., Soussana, J. F., Tubiello, F. N., Chhetri, N., Dunlop, M., & Meinke, H. (2007). Adapting agriculture to climate change. *Proceedings of the national academy of sciences*, *104*(50), 19691-19696. 12. Mertz, O., Mbow, C., Reenberg, A., & Diouf, A. (2009). Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel. *Environmental management*, *43*(5), 804-816. 13. Rickards, L., & Howden, S. M. (2012). Transformational adaptation: agriculture and climate change. *Crop and Pasture Science*, *63*(3), 240-250. 14. Rosenzweig, C., & Parry, M. L. (1994). Potential impact of climate change on world food supply. *Nature*, *367*(6459), 133-138. 15. Wheeler, Tim, and Joachim Von Braun. "Climate change impacts on global food security." *Science* 341, no. 6145 (2013): 508-513. 16. Ericksen, P. J., Ingram, J. S., & Liverman, D. M. (2009). Food security and global environmental change: emerging challenges.
Lecture 10	Climate change impacts, adaptation	**1. Costello, Anthony, et al. "Managing the health effects of climate change." *The Lancet* 373.9676 (2009): 1693-1733.** **2. Allen, Craig D., Alison K. Macalady, Haroun Chenchouni, Dominique Bachelet, Nate McDowell, Michel Vennetier, Thomas Kitzberger et al. "A global overview of drought and heat-induced tree mortality reveals**

Lecture	Content	Required (in bold) and recommended readings
	in different sectors: forestry, ecosystem-based, and community-based adaptation	**emerging climate change risks for forests." *Forest ecology and management* 259, no. 4 (2010): 660-684.** **3. Heller, Nicole E., and Erika S. Zavaleta. "Biodiversity management in the face of climate change: a review of 22 years of recommendations." *Biological conservation* 142.1 (2009): 14-32.** 4. Kirilenko, Andrei P., and Roger A. Sedjo. "Climate change impacts on forestry." *Proceedings of the National Academy of Sciences* 104.50 (2007): 19697-19702. 5. Bonan, G. B. (2008). Forests and climate change: forcings, feedbacks, and the climate benefits of forests. *science*, *320*(5882), 1444-1449. 6. Flannigan, M. D., Stocks, B. J., & Wotton, B. M. (2000). Climate change and forest fires. *Science of the total environment*, *262*(3), 221-229. **7.** Canadell, J. G., & Raupach, M. R. (2008). Managing forests for climate change mitigation. *science*, *320*(5882), 1456-1457.
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		capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, *19*(3), 354-365. 23. Biermann, F., & Boas, I. (2010). Preparing for a warmer world: Towards a global governance system to protect climate refugees. *Global environmental politics*, *10*(1), 60-88. 24. Hartmann, B. (2010). Rethinking climate refugees and climate conflict: rhetoric, reality and the politics of policy discourse. *Journal of International Development*, *22*(2), 233-246. 25. Djalante, Riyanti, Cameron Holley, and Frank Thomalla. "Adaptive governance and managing resilience to natural hazards." *International Journal of Disaster Risk Science* 2.4 (2011): 1-14. 26. Grafton, R. Quentin, Jamie Pittock, Richard Davis, John Williams, Guobin Fu, Michele Warburton, Bradley Udall et al. "Global insights into water resources, climate change and governance." *Nature Climate Change* 3, no. 4 (2013): 315.
Lecture 13	Climate change mitigation: Key policies and progesses	1. **1) Two pages of the UNFCCC website:** *** a) 'FOCUS: Mitigation', available at: unfccc.int/focus/mitigation/items/7169.php** *** b) 'FOCUS: Mitigation – Action on mitigation: Reducing emissions and enhancing sinks', available at: unfccc.int/focus/mitigation/items/7171.php** 2. **http://www.globalcarbonproject.org/** 3. Edenhofer, Ottmar, Ramon Pichs-Madruga, Youba Sokona, Kristin Seyboth, Patrick Matschoss, Susanne Kadner, Timm Zwickel et al. "IPCC special report on renewable energy sources and climate change mitigation." *Prepared By Working Group III of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK* (2011). 4. Ockwell, D. and A. Mallett (2012), Introduction', in: D. Ockwell and A. Mallett, Low-carbon Technology Transfer – From Rhetoric to Reality, Abingdon, Oxon, and New York: Routledge, pp. 3-19. 5. Mackey, Brendan, I. Colin Prentice, Will Steffen, Joanna I. House, David Lindenmayer, Heather Keith, and Sandra Berry. "Untangling the confusion around land carbon science and climate change mitigation policy." *Nature Climate Change* 3, no. 6 (2013): 552. 6. Aldy, J. E., & Pizer, W. A. (2015). The competitiveness impacts of climate change mitigation policies. *Journal of the Association of Environmental and Resource Economists*, *2*(4), 565-595. 7. Rogelj, Joeri, David L. McCollum, Andy Reisinger, Malte Meinshausen, and Keywan Riahi. "Probabilistic cost estimates for climate change mitigation." *Nature* 493, no. 7430 (2013): 79.
Lecture 14	Climate change mitigation at different sectors	8. Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Seyboth, K., Matschoss, P., Kadner, S., ... & von Stechow, C. (2011). IPCC special report on renewable energy sources and climate change mitigation. *Prepared By Working Group III of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK*.

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		9. Canadell, J. G., & Raupach, M. R. (2008). Managing forests for climate change mitigation. *science*, *320*(5882), 1456-1457. 10. Zomer, R. J., Trabucco, A., Bossio, D. A., & Verchot, L. V. (2008). Climate change mitigation: A spatial analysis of global land suitability for clean development mechanism afforestation and reforestation. *Agriculture, ecosystems & environment*, *126*(1-2), 67-80. 11. Gerber, Pierre J., Henning Steinfeld, Benjamin Henderson, Anne Mottet, Carolyn Opio, Jeroen Dijkman, Allessandra Falcucci, and Giuseppe Tempio. *Tackling climate change through livestock: a global assessment of emissions and mitigation opportunities*. Food and Agriculture Organization of the United Nations (FAO), 2013. 12. Bollen, J., Guay, B., Jamet, S., & Corfee-Morlot, J. (2009). *Co-benefits of climate change mitigation policies: literature review and new results* (No. 693). OECD Publishing. 13. Marland, G., Pielke Sr, R. A., Apps, M., Avissar, R., Betts, R. A., Davis, K. J., ... & Katzenberger, J. (2003). The climatic impacts of land surface change and carbon management, and the implications for climate-change mitigation policy. *Climate policy*, *3*(2), 149-157. 14. Gerber, Pierre J., Henning Steinfeld, Benjamin Henderson, Anne Mottet, Carolyn Opio, Jeroen Dijkman, Allessandra Falcucci, and Giuseppe Tempio. *Tackling climate change through livestock: a global assessment of emissions and mitigation opportunities*. Food and Agriculture Organization of the United Nations (FAO), 2013. 15. Rogelj, J., McCollum, D. L., Reisinger, A., Meinshausen, M., & Riahi, K. (2013). Probabilistic cost estimates for climate change mitigation. *Nature*, *493*(7430), 79. 16. Büchs, M., Bardsley, N., & Duwe, S. (2011). Who bears the brunt? Distributional effects of climate change mitigation policies. *Critical Social Policy*, *31*(2), 285-307. 17. Mackey, B., Prentice, I. C., Steffen, W., House, J. I., Lindenmayer, D., Keith, H., & Berry, S. (2013). Untangling the confusion around land carbon science and climate change mitigation policy. *Nature Climate Change*, *3*(6), 552. 18. Lybbert, T., & Sumner, D. (2010). Agricultural technologies for climate change mitigation and adaptation in developing countries: policy options for innovation and technology diffusion. 19. Fellmann, T., Witzke, P., Weiss, F., Van Doorslaer, B., Drabik, D., Huck, I., ... & Leip, A. (2017). Major challenges of integrating agriculture into climate change mitigation policy frameworks. *Mitigation and Adaptation Strategies for Global Change*, 1-18. 20. Anderson, B., Bernauer, T., & Balietti, S. (2017). Effects of fairness principles on willingness to pay for climate change mitigation. *Climatic Change*, *142*(3-4), 447-461. 21. Brugnach, M., Craps, M., & Dewulf, A. R. P. J. (2017). Including indigenous peoples in climate change mitigation: addressing issues of scale, knowledge

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		and power. *Climatic change*, *140*(1), 19-32. 22. Riti, J. S., Shu, Y., Song, D., & Kamah, M. (2017). The contribution of energy use and financial development by source in climate change mitigation process: A global empirical perspective. *Journal of Cleaner Production*, *148*, 882-894. 23. Howden, S. Mark, Jean-François Soussana, Francesco N. Tubiello, Netra Chhetri, Michael Dunlop, and Holger Meinke. "Adapting agriculture to climate change." *Proceedings of the national academy of sciences* 104, no. 50 (2007): 19691-19696.