

1 **Instructor Notes: REVISED May 5, 2020**

2 1. For online resources regarding foundational information on plant biology and climate  
3 change please refer to the sources below. These resources contain basic prior knowledge  
4 students should have learned prior to their undergraduate career, for both specified topics.

5 - 12 Principles of Plant Biology (American Society of Plant Biology (ASPB)):

6 [aspb.org/education-outreach/k12-roots-and-shoots/the-12-principles-of-plant-](http://aspb.org/education-outreach/k12-roots-and-shoots/the-12-principles-of-plant-biology-2/#toggle-id-1)  
7 [biology-2/#toggle-id-1](http://aspb.org/education-outreach/k12-roots-and-shoots/the-12-principles-of-plant-biology-2/#toggle-id-1)

8 - Climate Change Education: Essential Information for Educators (National  
9 Education Association (NEA)): [www.nea.org/climatechange](http://www.nea.org/climatechange)

10 - Resources for Educators (U.S. Global Change Research Program):  
11 [www.globalchange.gov/browse/educators](http://www.globalchange.gov/browse/educators)

12 2. During the activity you will be acting as a food security specialist working for IRRI in the  
13 Philippines. During Day 2, after giving students the opportunity to brainstorm & passing  
14 out the specialty cards, you will introduce the students as to why they have been called to  
15 this meeting.

16 3. Before asking students to create a concept map, give students an outline of how to begin  
17 a concept map (**Figure 6**).

18 4. Throughout the activity walk around to check on groups, keep reminding them of the  
19 question they are trying to solve: what are the effects of warming on Philippines rice  
20 system status?

21 5. When assigning students to make an interconnected concept map that is incorporating  
22 facts from each specialty give them an example of how to start (**Figure 7**).

- 23 6. If a group is focusing on one specialty remind them that this is a collaborative effort and  
24 different specialties have different knowledge and skills. Make sure each group is  
25 incorporating information from all fields.
- 26 7. Classroom discussion comparing interconnected concept maps between groups: *act as the*  
27 *leader of the discussion.*
- 28 - First: Ask students to point out some comparisons they noticed between the maps:  
29 what is the same and what is different? *Write these down for the students to follow.*
  - 30 - Second: Ask if they agree or disagree with these contrasts? How did it change their  
31 view on the topic?
  - 32 - Third: Ask student groups to share a solution they came up with, then ask if other  
33 groups had similar solutions or different.
  - 34 - Questions to pose for students: Are there any ways we can reduce these negative  
35 impacts expected on agricultural systems? What are other aspects that we should be  
36 focusing on?
- 37 8. While this lesson plan is intended for an entry-level science college course, it would also  
38 work well in an introductory plant biology college course or upper-level biology college  
39 course. For use in an upper-level biology course, it is recommended that the instructor  
40 assigns peer reviewed review articles to each specialty group in place of or alongside the  
41 papaya ring-spot virus case study. References for examples of peer review articles that  
42 are useful for this exercise are listed below:
- 43 - *Plant Pathologist*: Noctor, G., Mhamdi, A. (2017) Climate change, CO<sub>2</sub>, and  
44 defense: The metabolic, redox, and signaling perspectives. *Trends in Plant*  
45 *Science*, 22, 857-870. doi: 10.1016/j.tplants.2017.07.007

- 46 - *Climatologist*: Naumann, G., Alfieri, L., Wyser, K., Mentaschi, L., Betts, R.A.,  
47 Carrao, H., Spinoni, J., Vogt, J., Feyen, L. (2018) Global change in drought  
48 conditions under different levels of warming. *Geophysical Research Letters*, 45.  
49 doi: 10.1002/2017GL076521
- 50 - *Agricultural Economist*: Stevanovic, M., Popp, A., Lotze-Campen, H., Dietrich,  
51 J.P., Muller, C., Bonsch, M., Schmitz, C., Bodirsky, B.L., Humpenoder, F.,  
52 Weindl, I. (2016) The impact of high-end climate change on agricultural welfare.  
53 *Science Advances*, 2, e1501452. doi: 10.1126/sciadv.1501452.
- 54 - *Agronomist*: Altieri, M.A., Nicholls, C.I. (2013) The adaptation and mitigation  
55 potential of traditional agriculture in a changing climate. *Climate Change*, 140,  
56 33-45. doi: 10.1007/s10584-013-0909-y
- 57 9. *If desired*, Days 1 and 2 can be combined into one day if instructor has time for each  
58 student to individually read the case study in class.
- 59 10. *If desired*, the case study & lesson plan can be easily modified for teaching other  
60 scientific topics. This lesson plan is aimed to teach students about plant pathology,  
61 agriculture, and climate change but many aspects can be modified for other important  
62 scientific topics in different fields.
- 63 11. *Want to make the lesson more fun?* Provide students with costumes or props to be used  
64 depending on their specialty group. Can also provide certain specialty groups with  
65 “breaking news”, this will give the students new information to use when creating a  
66 concept map and provide a more “urgent” or “emergency” feel.