

# What are the primary growing environments for rice?

This is the 1st module of a training course titled:  
*Submerged Soils for Rice Production*

An interactive version of this presentation can be viewed  
at this site:

<http://www.knowledgebank.irri.org/submergedsoils>

# Intro to Module 1

Rice is grown on 6 continents and in more than 100 countries. It is produced in different environments and in many ways.

- Purpose: to introduce the main rice production environments and some basic information about how rice is grown in these environments.
- Organization:
  - Lesson 1 – Introduction of rice growing environments
  - Lessons 2–4 – Description of different environments

# Lesson 1 – Rice Growing Environments

- Lesson 1: What are the primary rice growing environments?
- Objective: Get an overview of the main rice-growing environments and where they are located.

# Lesson 1 – Importance of rice

Rice:

- A staple food for more than half the world's population
- In rice producing regions of Asia, hundreds of millions depend on it for their livelihood



# Lesson 1 – Submerged or aerobic soil

- Unlike other major food crops, rice grows well in soils submerged by water
- It also grows in non-flooded aerobic soils



# Lesson 1 – Two types of rice production

Rice production can be divided into lowland or upland

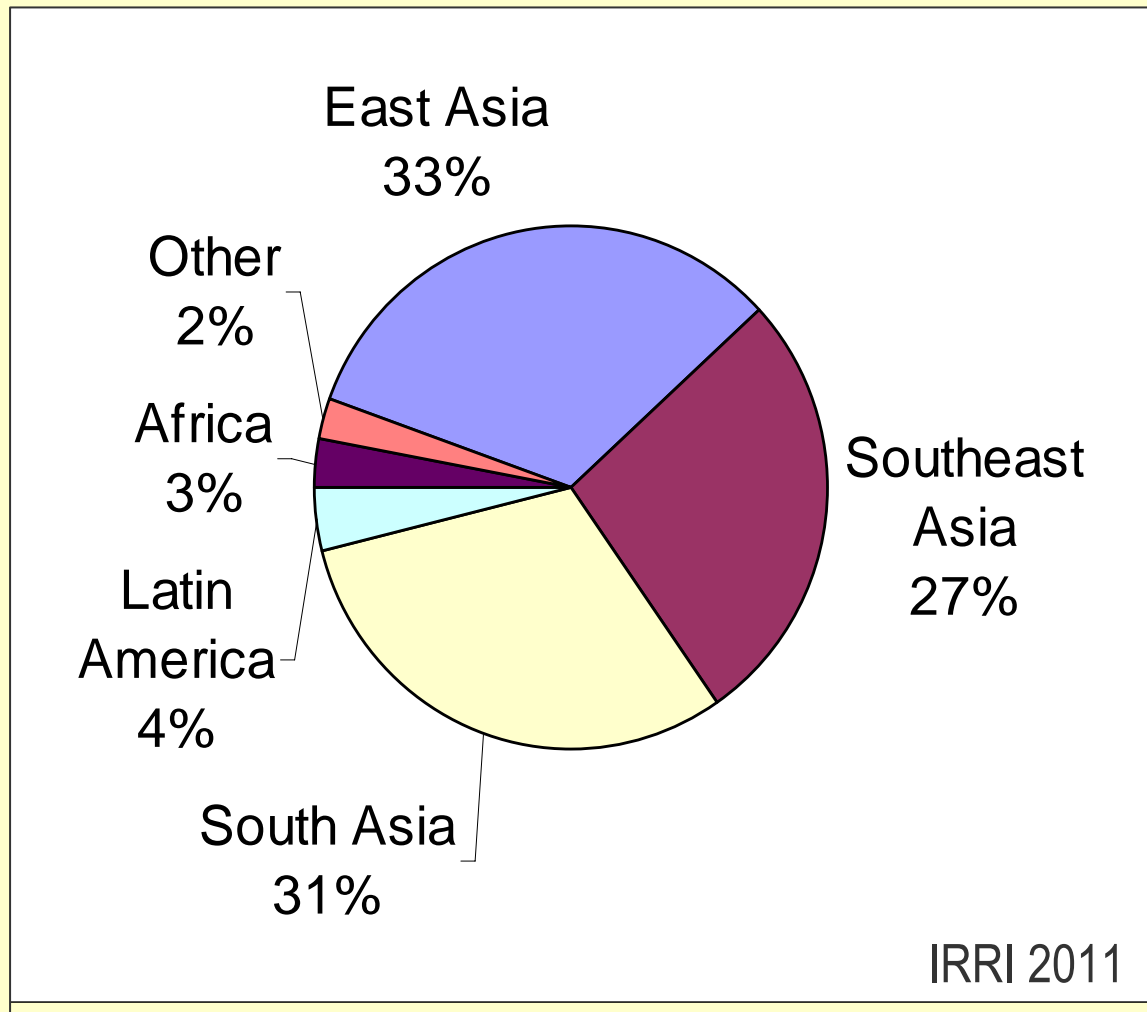
- Lowland and upland refer to a method of rice production rather than an elevation where rice is produced

Type	Lowland	Upland
Discussed in:	Lesson 2 & 3	Lesson 4
Total land area (%)	90	10
Main difference	Soil is submerged for part or all of crop growth	Soil is not intentionally submerged

# Lesson 1 – Lowland rice production

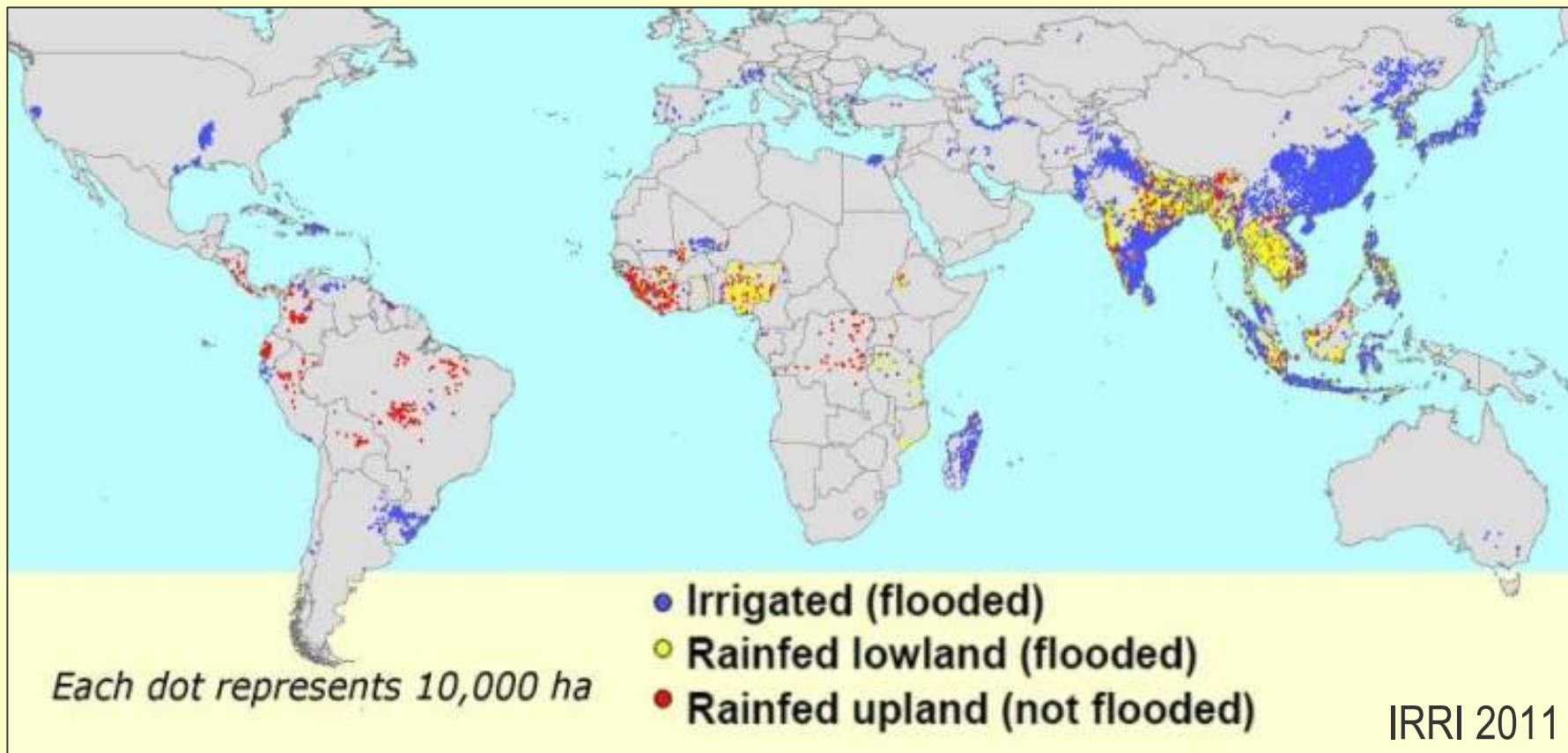
- Lowland rice is further divided, based on the availability of irrigation water, into:
  - irrigated lowland (discussed in Lesson 2) or
  - rainfed lowland (discussed in Lesson 3)
- *This e-learning course is focused primarily on lowland rice production*

# Lesson 1 – Rice production by region





# Lesson 1 – Rice production by ecosystem



# Lesson 1 – Rice production by ecosystem

Rice Ecosystem	Total Production Area (%)	Total Rice Production (%)
Irrigated lowland	55-60	≈ 75
Rainfed lowland	≈ 30	≈ 20
Rainfed upland	≈ 10	<5

Following is a link to more rice production statistics:

<http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1285>

# Lesson 1 – Summary slide

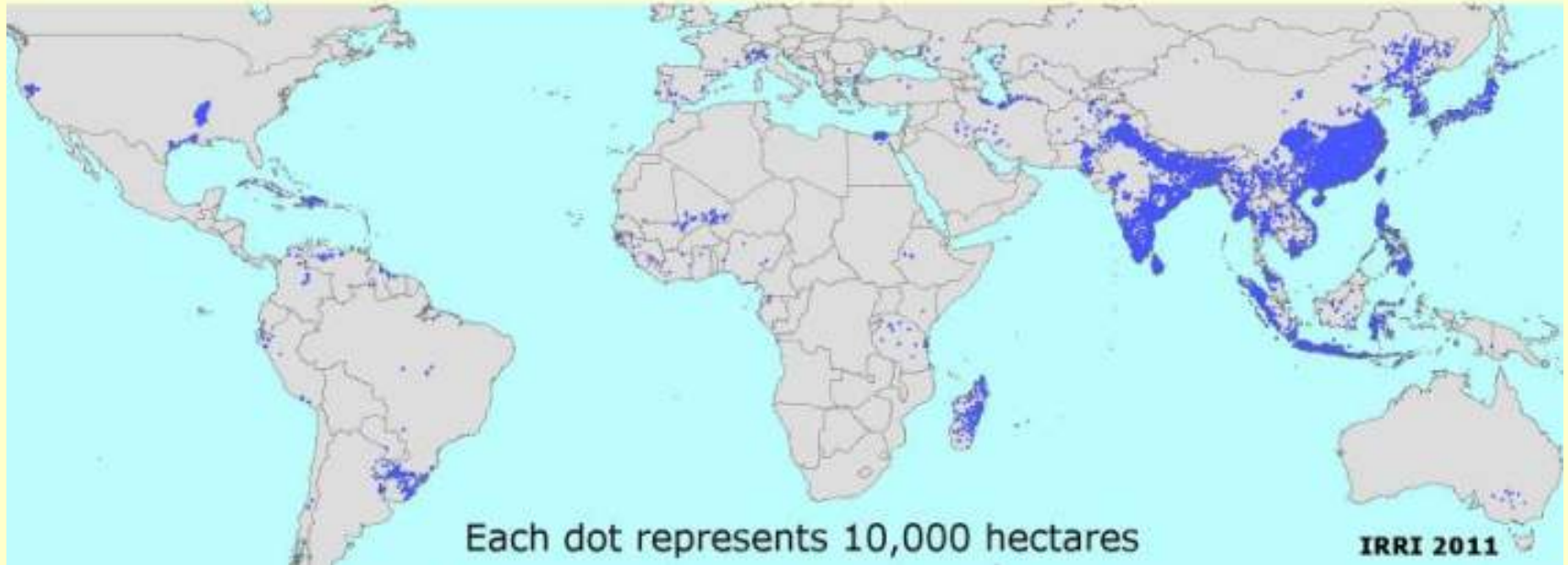
- Rice provides food and livelihood for people around the globe and particularly in Asia
- Rice production can be divided into two methods referred to as lowland and upland
- Lowland production is subdivided into irrigated and rainfed depending on water availability
- This course focuses on lowland rice production and what happens when soils are submerged

# Lesson 2 – Irrigated lowland

- Lesson 2: What are the characteristics of the irrigated lowland ecosystem?
- Objective: Be able to discuss the characteristics and production area of irrigated lowland.

# Lesson 2 – Irrigated rice production

## Irrigated lowland rice production



More than half the land area devoted to rice production is irrigated

# Lesson 2 – Irrigated lowland ecosystem

- Availability and control of water helps reduce risk of crop failure
  - As a result, farmers have more capacity to apply inputs like fertilizer to increase yield
- Two and even three crops per year may be possible with adequate irrigation
- Most productive rice ecosystem
  - Accounts for 75% of world's annual rice production



# Lesson 2 – Irrigation

- Irrigation may be applied:
  - as supplement in the rainy season and/or
  - during the dry season:
- Methods of irrigation depend on factors like:
  - water sources available
  - available technology
  - cost



# Lesson 2 – Common characteristics of irrigated lowland (1)

- Where can you find irrigated rice production?
  - It can be found in many varying topographies such as flood plains, lower slopes, valley bottoms, and terraced fields.





# Lesson 2 – Common characteristics of irrigated lowland (2)

- How is water retained in the rice field?
  - Each field, or paddy, is surrounded by a mound of earth called a bund.



# Lesson 2 – Common characteristics of irrigated lowland (3)

- How is a field typically prepared?
  - Before establishing rice, the field is puddled. Puddling involves saturating the soil with water and then plowing and tilling it. This is done for several reasons – see Module 2 Lesson 6 for more detail.



# Lesson 2 – Common characteristics of irrigated lowland (4)

- What is the typical method for establishing rice?
  - Transplanting of seedlings from a nursery into the prepared paddy.
  - Direct wet-seeding, where seeds are sown on the surface of the wet paddy, is also used



# Lesson 2 – Common characteristics of irrigated lowland (5)

- When are irrigated fields typically flooded?
  - A layer of water covers the soil for all or most of the growing season.



# Lesson 2 – Something to think about

Irrigated rice requires considerable water.

- Each kg of produced rice requires 3,000 to 5,000 liters of water.
- One rice crop requires 1,000 to 3,000 mm of water from a combination of irrigation and rain.
- The total water used to irrigate rice amounts to 24 to 30% of the global withdraw from freshwater supply annually.

# Lesson 2 – Summary slide

- More than half the total land area for rice production is irrigated
- Before establishing the rice, the field is typically puddled.
- Seedlings are usually transplanted in the field
- Soil will be submerged for part or all of the cropping season
- Irrigated rice requires a significant amount of freshwater

# Lesson 3 – Rainfed lowland

- Lesson 3: What are the characteristics of rainfed lowland and where is it practiced?
- Objective: Describe rainfed lowland and identify areas where it is used.

# Lesson 3 – Rainfed lowland ecosystem (1)

The rainfed lowland ecosystem may be found in similar areas as the irrigated lowland ecosystem...





# Lesson 3 – Rainfed lowland ecosystem (2)

However, rainfed lowland areas do not have water supply and/or water control for irrigation.

- They are more prone to drought and to flooding
- Different varieties and management systems are used in rainfed lowlands to address these risks



# Lesson 3 – Common characteristics of rainfed lowland (1)

## Field Preparation:

- Fields are typically plowed and puddled after the onset of the rainy season
- Bunds are used to contain water
- Soil is submerged for part of the cropping season



# Lesson 3 – Common characteristics of rainfed lowland (2)

## Crop establishment:

- Rice seedlings are typically transplanted
- Other methods include direct seeding
  - onto wet puddled soil
  - in dry soil



# Lesson 3 – Common characteristics of rainfed lowland (3)

Rice production:

- One or possibly two rice crops are grown per year
- Yields are typically lower and more variable than irrigated rice

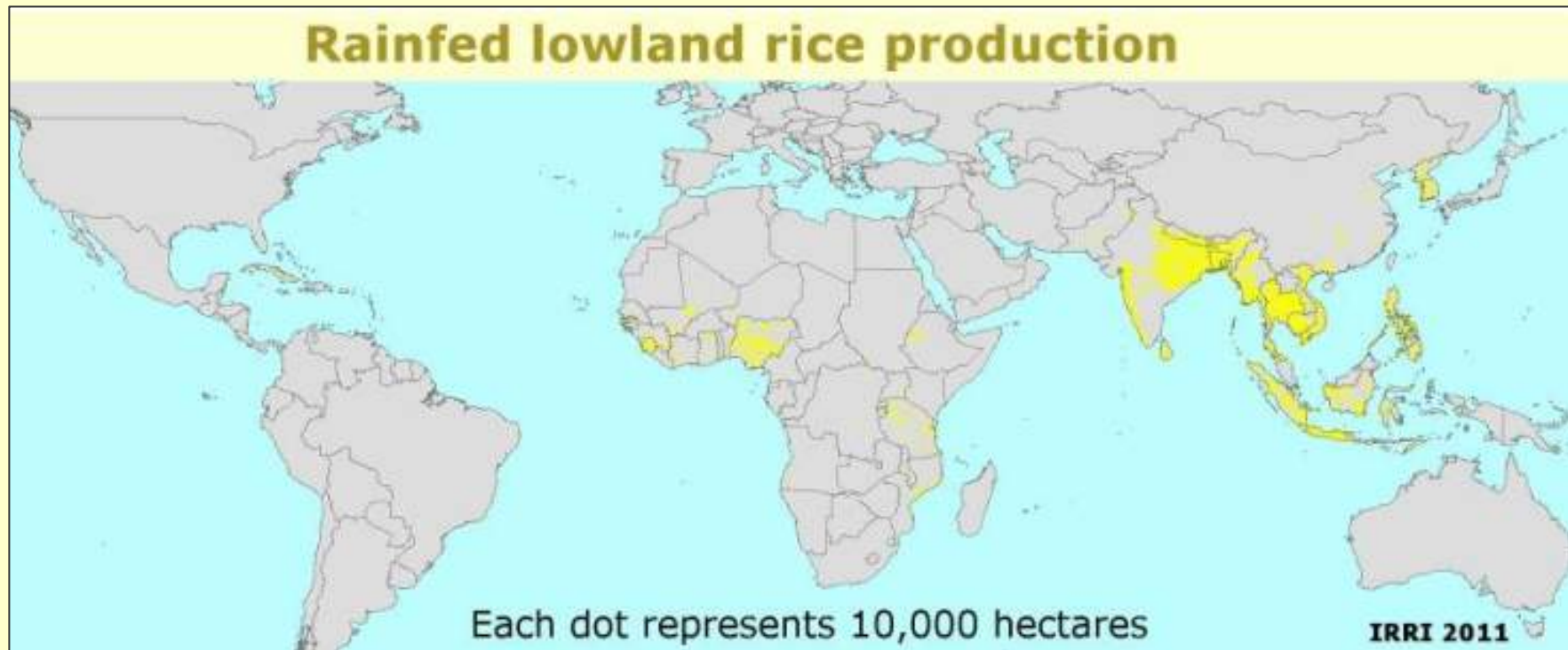


# Lesson 3 – Salinity affects some rainfed lowland areas

- Salinity can be a problem in coastal areas due to sea water flooding and lack of irrigation for salt removal



# Lesson 3 – Production area for rainfed lowland rice



# Lesson 3 – Summary slide

- The area for the lowland rice ecosystem can be similar to irrigated lowland except it lacks water supply and/or water control for irrigation
- More risks are associated with rainfed lowland such as drought and flooding.
- Plowing and puddling typically take place once the rainy season has started
- Yields are typically lower and more variable compared to irrigated rice

# Lesson 4 – Rainfed upland rice production

- Lesson 4: What are the characteristics of rainfed upland ecosystems and where are they located?
- Objective: Be able to describe upland rice production and where it is used.



# Lesson 4 – Rainfed upland rice production

Rice produced under aerobic conditions without irrigation and without puddling

- It includes a range of environments from valley bottoms to steep sloping areas
- Often used by subsistence farmers in Asia, Africa, and Central America



# Lesson 4 – Common characteristics of rainfed upland (1)

- Practiced in mountainous areas with fragile ecosystems
- Seeds are broadcast or dibbled into dry soil prior to the rainy season
- Soil remains aerobic throughout much or all of the growing season



# Lesson 4 – Common characteristics of rainfed upland (2)

- Little or no purchased inputs are applied
- Yield levels are typically low
- One rice crop per year



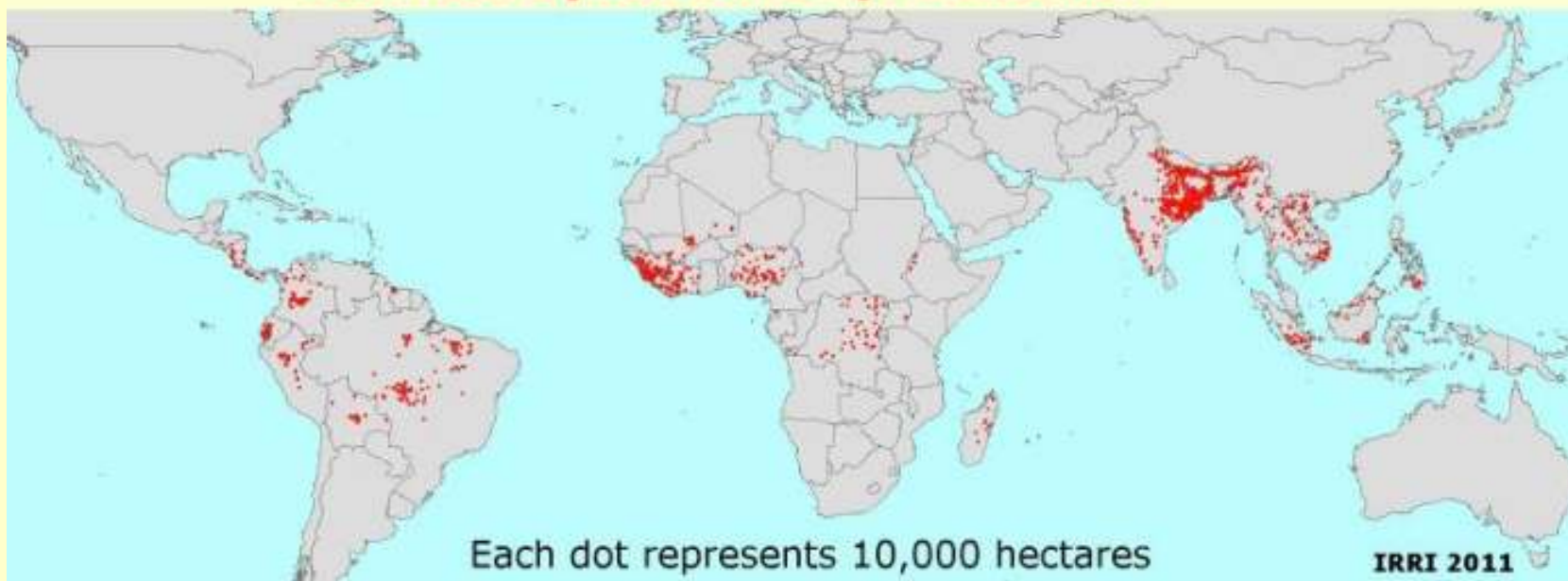
# Lesson 4 – Challenges of rainfed upland

- Several factors limit yield in rainfed upland areas:
  - Drought
  - Problem soils
  - Pests – weed, insects, nematodes, etc.
- Rainfed upland accounts for 10% of total rice area but only 4% of total rice production



# Lesson 4 – Map of rainfed upland rice production areas

## Rainfed upland rice production



# Lesson 4 – Summary slide

- Upland rice is produced under dry conditions without irrigation or puddling
- It is found in different terrains but is often used in mountainous areas by subsistence farmers
- Usually one crop per year with relatively low yield
- Many factors limit yield including drought and weeds

# Review Questions for Module 1

1) Match the rice ecosystem with its corresponding statement:

Irrigated  
lowland

- Seed is placed in soil that remains aerobic throughout much or all of the growing season

Rainfed  
lowland

- Water control reduces the risk of flooding and/or drought in this ecosystem

Rainfed  
upland

- Puddling of fields for rice cultivation starts after the onset of rains

# Review Questions for Module 1

- 2) Identify which statement is true for the irrigated lowland rice ecosystem
- a) Soil is puddled after transplanting seedlings
  - b) Irrigated lowland rice is found only in flat low lying areas which can be easily irrigated
  - c) There is less land area in irrigated lowland than rainfed lowland
  - d) Irrigated rice accounts for 75% of the total annual rice production



# Review Questions for Module 1

- 3) *True or False* The yield of rice in the rainfed uplands is usually comparable to the irrigated lowland.
- 4) Which statement(s) below are characteristic of the rainfed lowland ecosystem:
- Plowing and puddling often takes place after the onset of the rainy season
  - Rice is usually transplanted into the paddy but may also be direct seeded
  - Salinity can be a problem in coastal areas since irrigation is not available for salt removal
  - All of the above

# Answers to Review Questions

1. Rainfed upland - Seed is placed in soil that remains aerobic throughout the growing season

Rainfed lowland - Puddling of fields for rice cultivation starts after onset of rains

Irrigated lowland - Water control reduces the risk of flooding and/or drought in this ecosystem

# Answers to Review Questions

2. d. (Lesson 2)
3. false (Lesson 4)
4. d. all of the above (Lesson 3)