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](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

<table>
<thead>
<tr>
<th>Type</th>
<th>Lowland</th>
<th>Upland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussed in:</td>
<td>Lesson 2 &amp; 3</td>
<td>Lesson 4</td>
</tr>
<tr>
<td>Total land area (%)</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>Main difference</td>
<td>Soil is submerged for part or all of crop growth</td>
<td>Soil is not intentionally submerged</td>
</tr>
</tbody>
</table>
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

- East Asia: 33%
- Southeast Asia: 27%
- South Asia: 31%
- Latin America: 4%
- Africa: 3%
- Other: 2%

IRRI 2011
Lesson 1 – Rice production by ecosystem

Each dot represents 10,000 ha
## Lesson 1 – Rice production by ecosystem

<table>
<thead>
<tr>
<th>Rice Ecosystem</th>
<th>Total Production Area (%)</th>
<th>Total Rice Production (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated lowland</td>
<td>55-60</td>
<td>≈ 75</td>
</tr>
<tr>
<td>Rainfed lowland</td>
<td>≈ 30</td>
<td>≈ 20</td>
</tr>
<tr>
<td>Rainfed upland</td>
<td>≈ 10</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

Following is a link to more rice production statistics:

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

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.
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.
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
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

Rainfed lowland rice production

Each dot represents 10,000 hectares

IRRI 2011
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
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
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
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:
   a. Plowing and puddling often takes place after the onset of the rainy season
   b. Rice is usually transplanted into the paddy but may also be direct seeded
   c. Salinity can be a problem in coastal areas since irrigation is not available for salt removal
   d. 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)