29/07/13

Lecture 1: World Agriculture Production

The future of food and farming Drivers of change affecting the food system

- For the first time, there is now a high likelihood that growth in the global population will cease, with the number of people leveling in the range of eight to ten billion towards the middle of the century.
- Human activities have now become a dominant driver of the Earth system: decisions made now to mitigate their detrimental effects will have a very great influence on the environment experienced by future generations, as well as the diversity of plant and animal species with which they will share the planet.
- There is now a developing global consensus, embodied in the Millennium Development Goals, that there is a duty on everyone to try to end poverty and hunger, whether in low-income countries or among the poor in more wealthy nations.
- In summary:
  - 1. Population growth will cease mid century at 8 to 10 billion
  - 2. Human activities have become a dominant driver of the "Earth System"
  - 3. Consensus that we must end poverty and hunger

Australia, south and north America have high calorie intake as well as high food production per capita

Price of food is increasing
Global cereal stores are depleting

The average cropland per person has remained relatively stable ($2500m^2$/person) but the amount of people has increased.
The amount of land cant increase much more, the intensity of cropping cant be increased much more, its only the yield increases that must be increased to get the required levels of food.

Wheat, rice, maize and soybeans are the major crops in the world.

It has been estimated that the number of people fed in a year per hectare ranges from 22 for potatoes and 19 for rice to 1 and 2, respectively, for beef and lamb.
To produce 1 kg of meat requires 16 kg grain

India - will overcome China to become the world’s most populous nation

Normally you'd need to plough to put a crop in – uses a lot a fuel. With no till, you don’t plough, but rather seed straight after harvest. This saves fuel.

In a normal field the farmers need to plough to get rid of weeds and then use a herbicide. Later they seed which is increases the amount of fuel. With no till and GM plants (roundup tolerant), they can seed straight to it and then spray so the plants can grow without weeds.

Global grain demand
- Human consumption increasing ~ 1% / year)
- Increasing demand for animal feed
- Food –v- Fuel -30% of 2008 US maize for ethanol -Biodiesel in Europe (tripled last 3 yrs)

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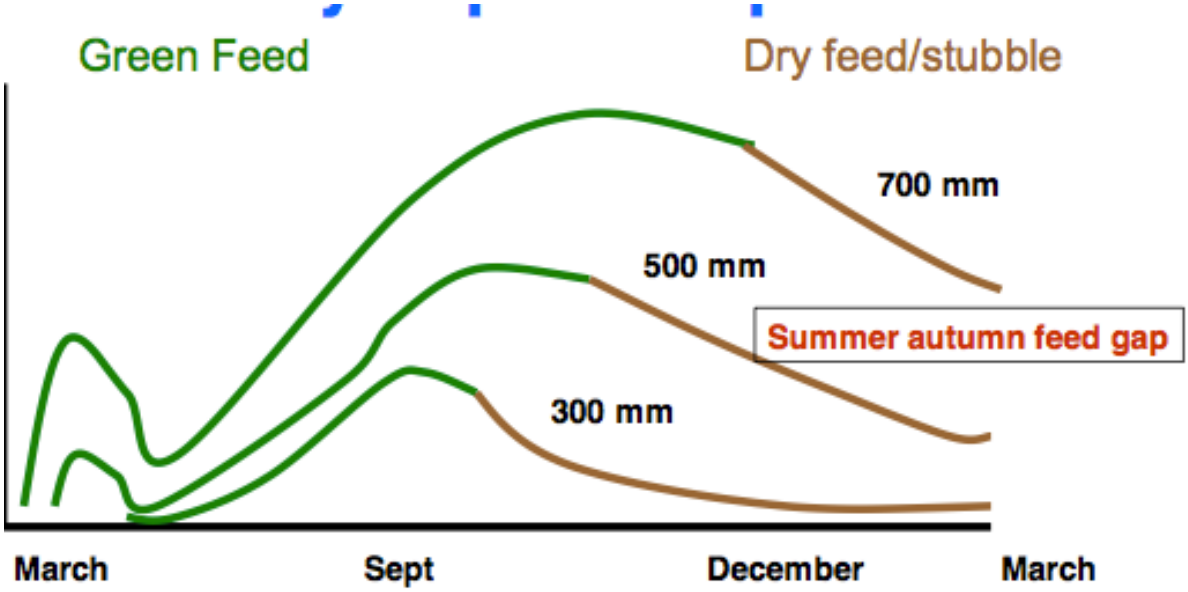
Lecture 2: WA cropping

- Australia has only 21 million people but Australian agriculture produces food for 60 million people and wool/cotton for 300 million people

Australia has a total of 768 million hectares 36.6 hectares/person
- Annual seeded crops 30 million ha
- Seeded pastures 30 million ha (60 million ha is only 8% of land mass)
- 75-80 million sheep
- 35 million cattle

mostly winter cropping in SWA, in S/central, all year, in eastern states mostly summer crops (rain fall effects).
The temperature also effects the growth of the plants in conjunction with the moisture.

Seasonality of pasture production:



Challenge: seasonlaity of production
- Limits stocking rate and thus profits
- Poor quality feed limits productivity in autumn feed gap

Pasture solutions:
- Summer active perennial pastures

- Legumes, grasses, shrubs

Mediterranean climate

- South west agricultural areas of WA have a dry-summer sub- tropical (Mediterranean) climate
- Similar to:
  - Mediterranean basin
  - Western tip of Cape Province, South Africa
  - Southern California
  - Chile
- Mediterranean climates are rare
  - < 2% of the earth's land surface
  - But, they harbour ~ 48 250 species of plants (~20% world's total)
  - Hence POTENTIAL CONFLICT between conservation and land uses such as agriculture

What is a Mediterranean climate?

- Warm to hot summers
- Mild and wet winters
- 275-900 mm annual rainfall
- > 65% of rainfall occurs in winter (potential waterlogging)
- Very dry in summer and autumn
- But, some sporadic rainfall in summer

Three characteristics of Mediterranean climates (expressed strongly in SW WA) are:

1. Concentration of rainfall in winter with summers being nearly, or completely dry
2. Warm to hot summers and mild winters
3. High solar radiation, especially in summer - autumn-winter-spring growing season

- less rainfall in more eastern parts of WA. But the northern areas have a faster growing season.
- Annual rainfall decreases rapidly from ~ 1200 mm on the S and SW coasts to around 250 mm at the inland limit of agriculture

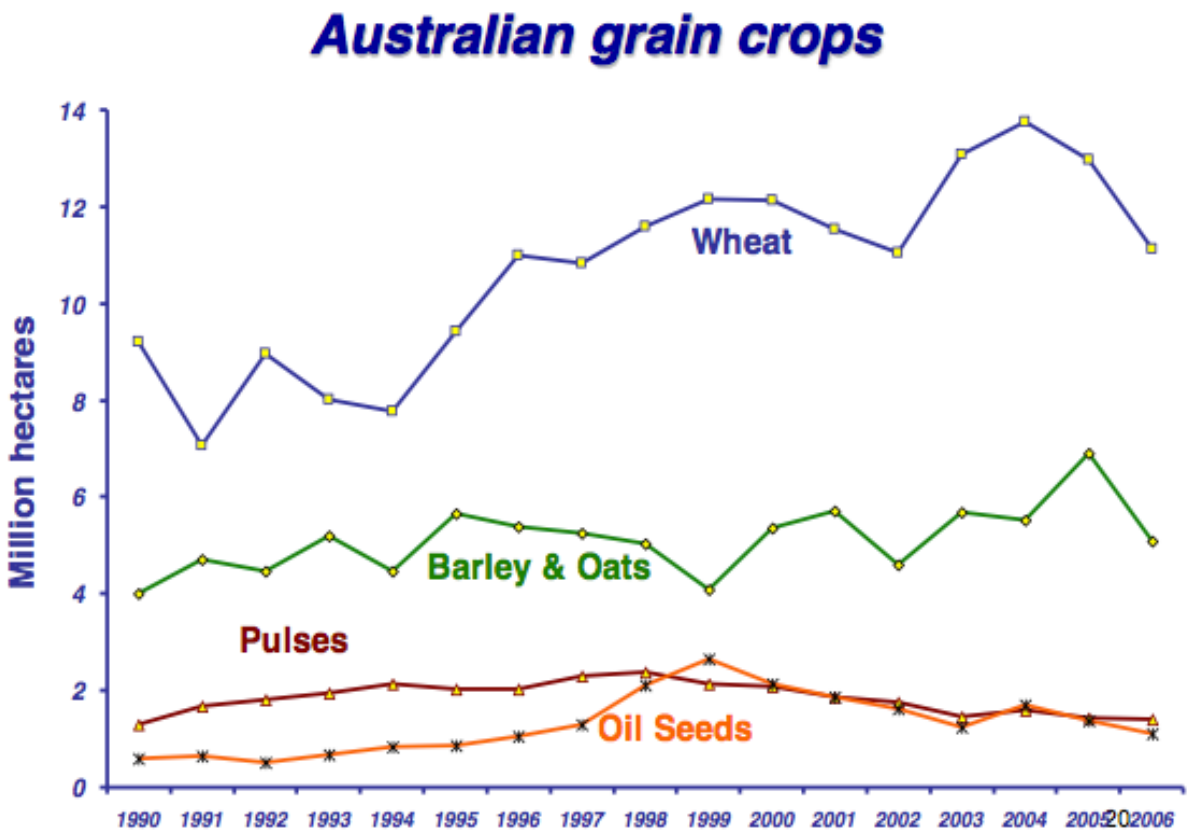
- Rainfall distribution peaks sharply in mid winter, especially in the W and NW wheatbelt

Possible phase rotation
Wheat → Lupins → Canola → Wheat → Pasture → Pasture

- Phase' pastures are those where there is expectation of regeneration from one pasture year to the next but no expectation of regeneration following a crop or crops grown in rotation (re- sowing occurs at the start of each pasture phase).
- 'Ley' pasture are those where it is anticipated that the pasture will regenerate each year - either following a previous pasture or following a crop grown in rotation with the pasture.

Phase systems are increasing because:
- Profitability of cropping > livestock
- Complementary interactions between crops in sequence greater than those between crops and pastures
- But, pastures continue to contribute important systems benefits
  - Fertility build-up, weed control, pest and disease management
- Pasture species which fit the need of these systems are increasingly available

1970's & onwards
- Sheep numbers declined as wool price dropped
- Cropping greatly expanded, mainly wheat
- New technology:
  - Herbicides
  - No tillage
  - BIG machinery
  - BIG farms (>2,500 ha)



Australian broad-acre cropping driven by wheat

Production

- World 600 m.t
- Australia 26 m.t (4.3%)

World export trade

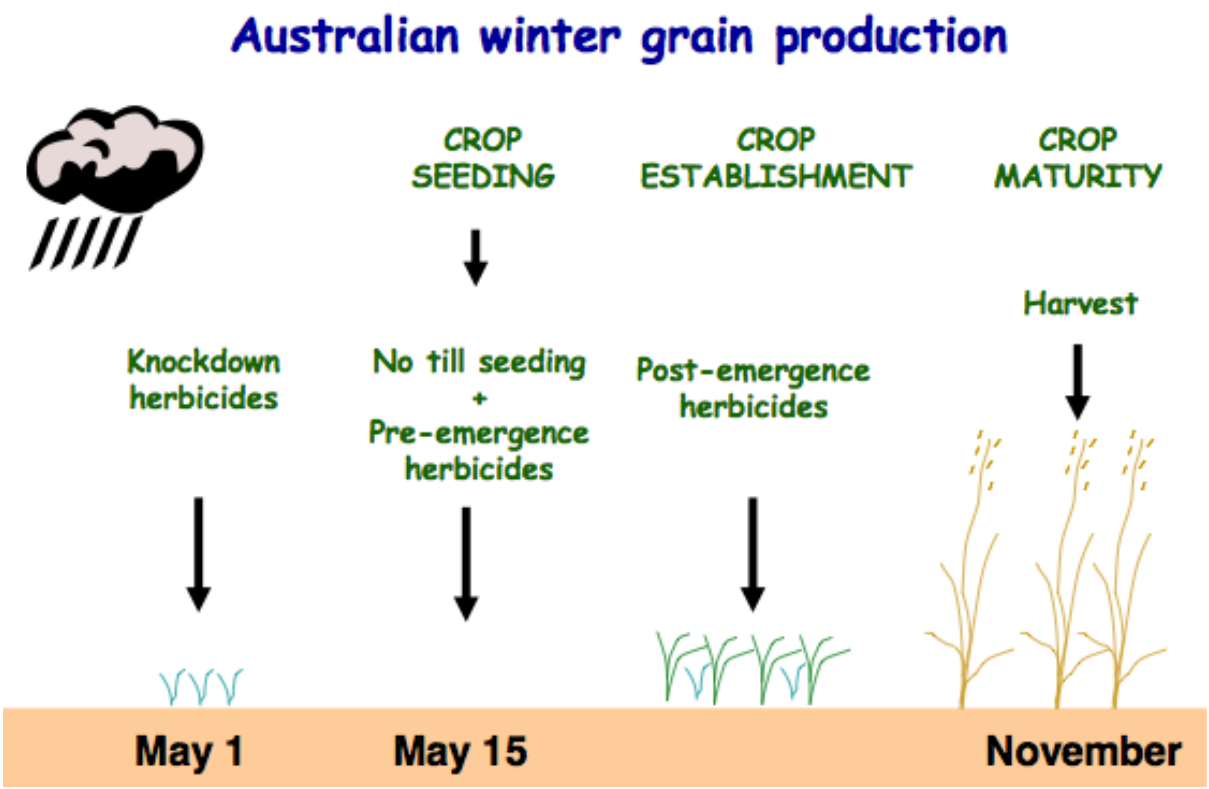
- World 108 m.t
- Australia 20 m.t (18% = 3rd)

	million ha.	million tonnes
Wheat	13	26
Barley	3.8	8.5
Canola	1.0	1.6
Lupins	0.6	1
Summer	1.1	3.5

80% exported

Australian cropping farms

- Big, but still single family farms (> 2,500 ha)
- Highly mechanized with little hired labour
- Minimum or NO tillage
- Strong herbicide dependence
- Wheat the main crop then barley, canola, lupins
- Low input/low output
- Low rainfall
- Poor soils (1% organic matter)



Paraquot, diquot are other herbicides that only kill smaller plants. It burns older plants leaves but wont necessarily kill them. They are used to reduce weed resistance to roundup.

Southern Australian grain belt:

- Mediterranean rain-fed climate (250-500 mm)
- May-October growing season
- Weathered soils with low natural fertility
- Rainfall key yield driver
- Efficient crop water use achieved with no till (tilling increases evaporation, no till keeps organic matter ontop of the soil that reduces soil temperature and reduces water loss) & early seeding (kg crop per mm drop)
- Wheat the dominant crop (14 million ha)
- Long hot summer (insect/disease break over the summer break when there's nothing growing)

WA produces 45% of Australian grain and exports 95% of wheat

from 2004-2013

canola jumped to 5-12%
Legumes from 21- 3% - driven by price – effects the N concentration in soils
Cereals from 74-85%