Global water cycles, Climate Change and Agriculture

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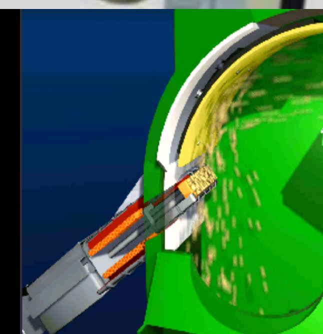
Precision Agriculture

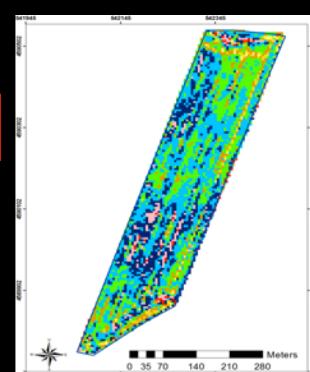
GPS receiver

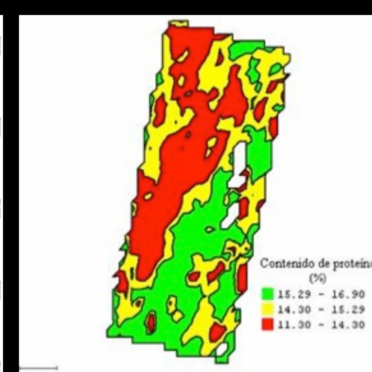
computer



Flow mass yield sensor

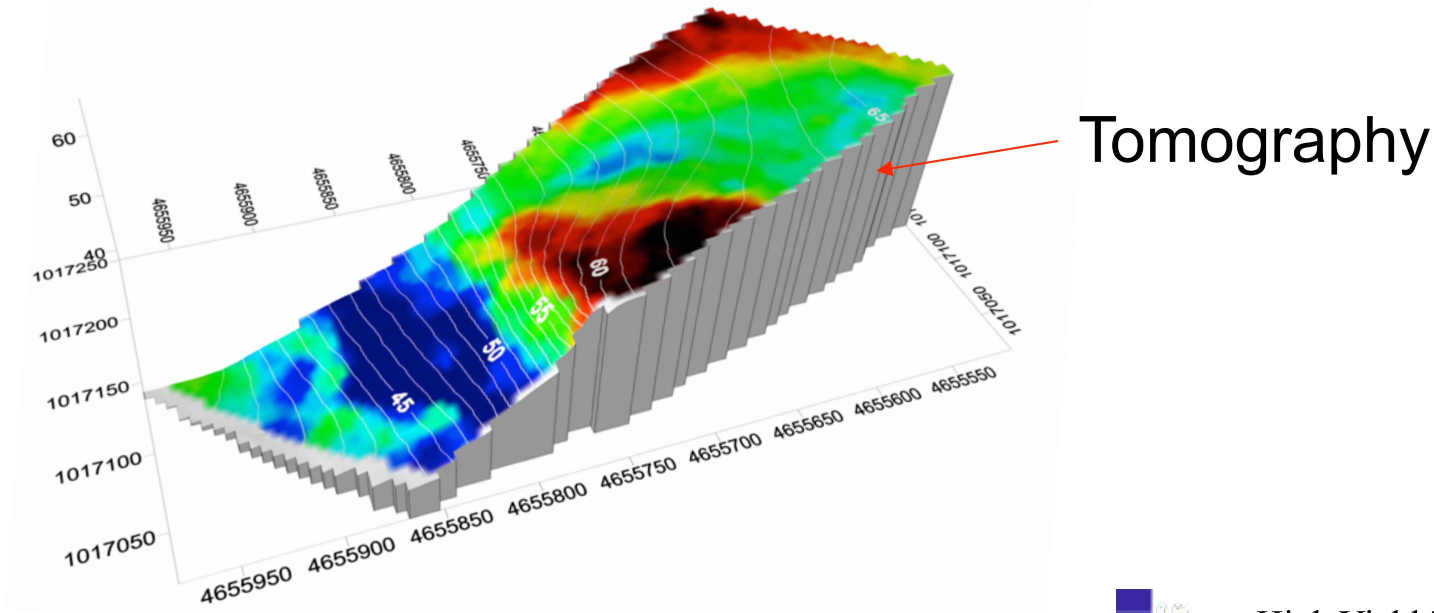
Yield map

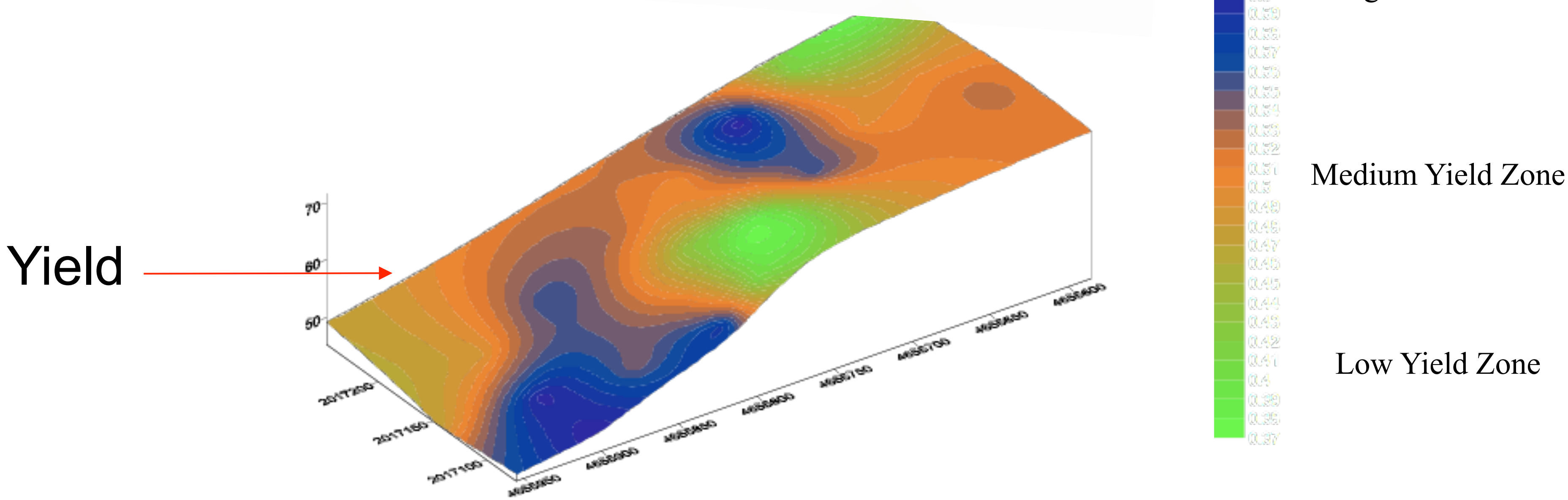




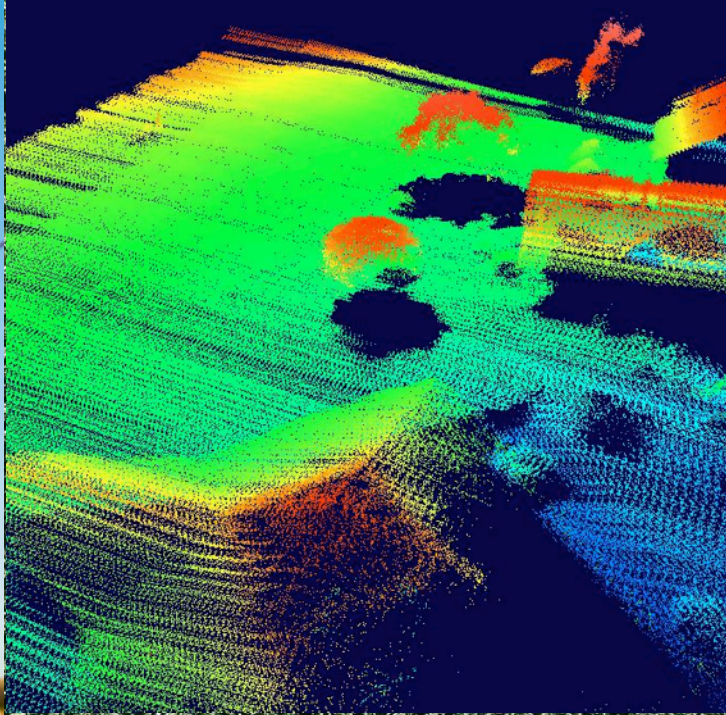
Protein map

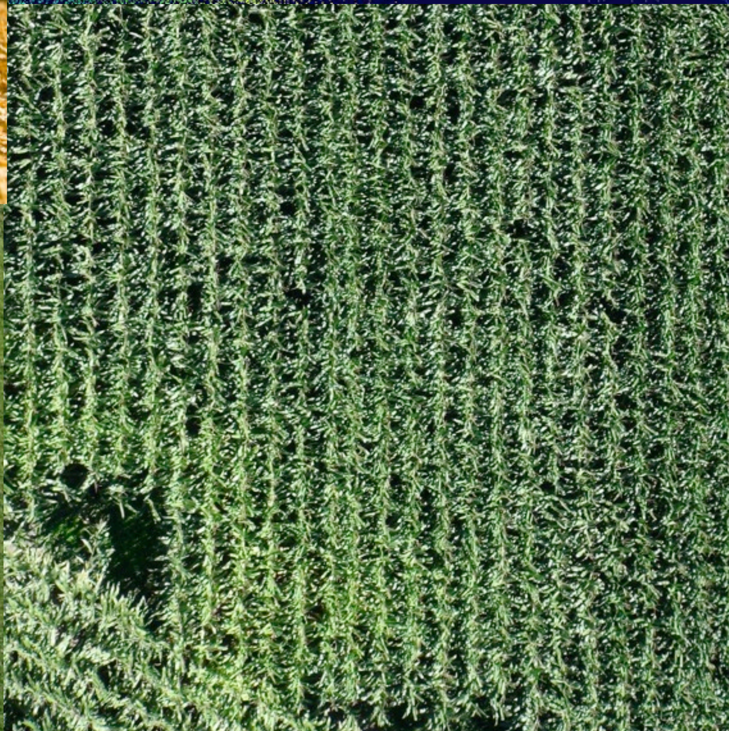
Homogeneous zones





UAV model: mdr4-1000 – microdrones.com

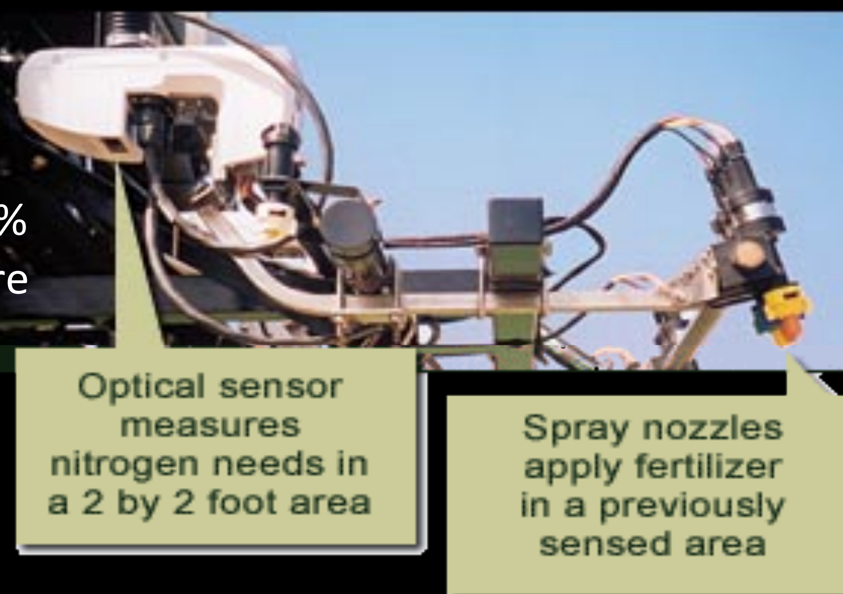




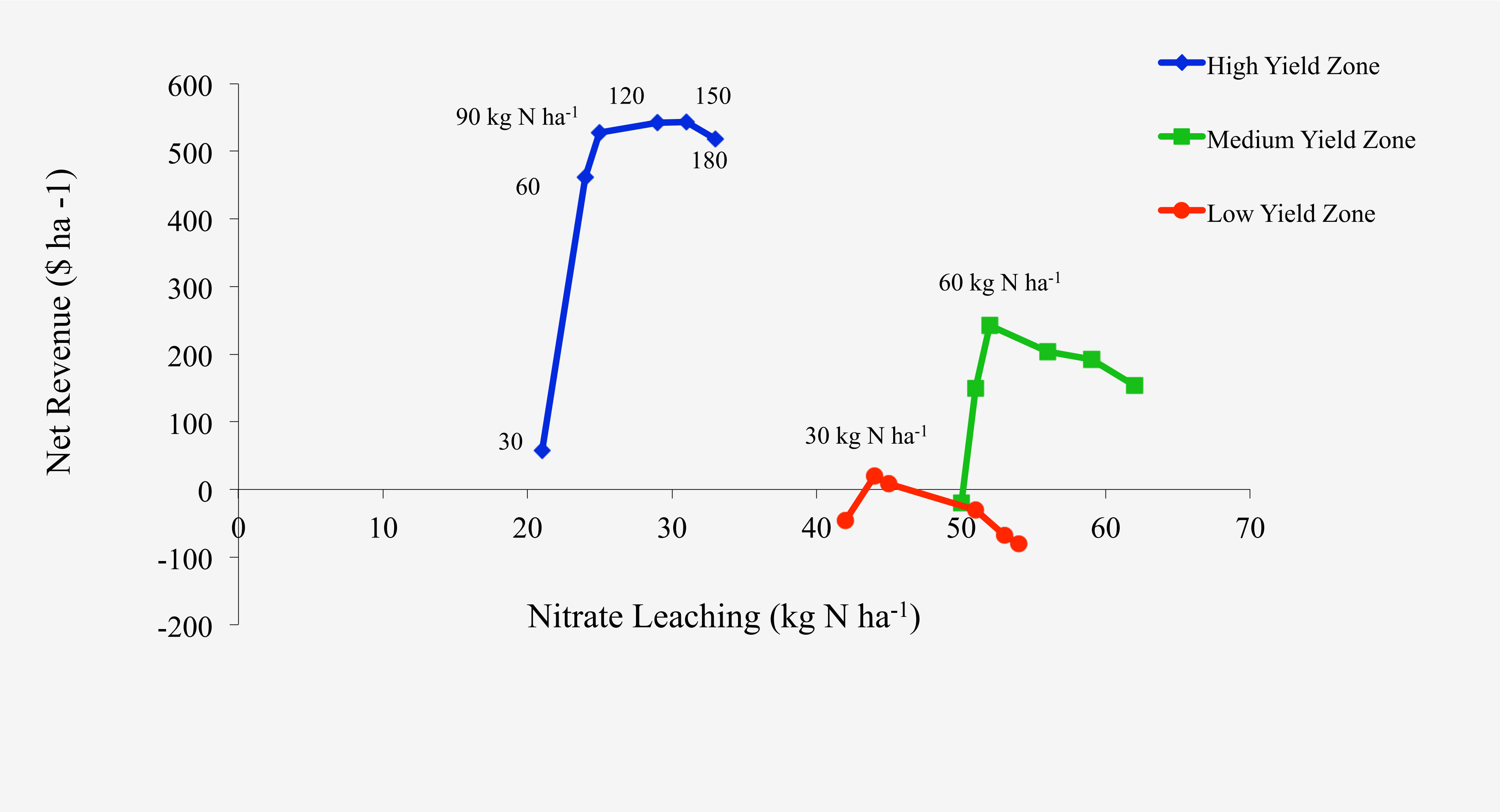
md4-1000 is equipped with RGB digital video-camera, thermal camera, hyperspectral, laser scanner.

Spatial resolution 1-5 cm
Payload 1.5 kg, Flying time 30-45 minutes with 1 battery

Crops take up only about 50% of the N fertilizer added (NUE), with the remaining 50% subject to escape to waters or the atmosphere (Follett and Delgado 2002, Robertson 2014)



Strategic and tactical N management using SALUS

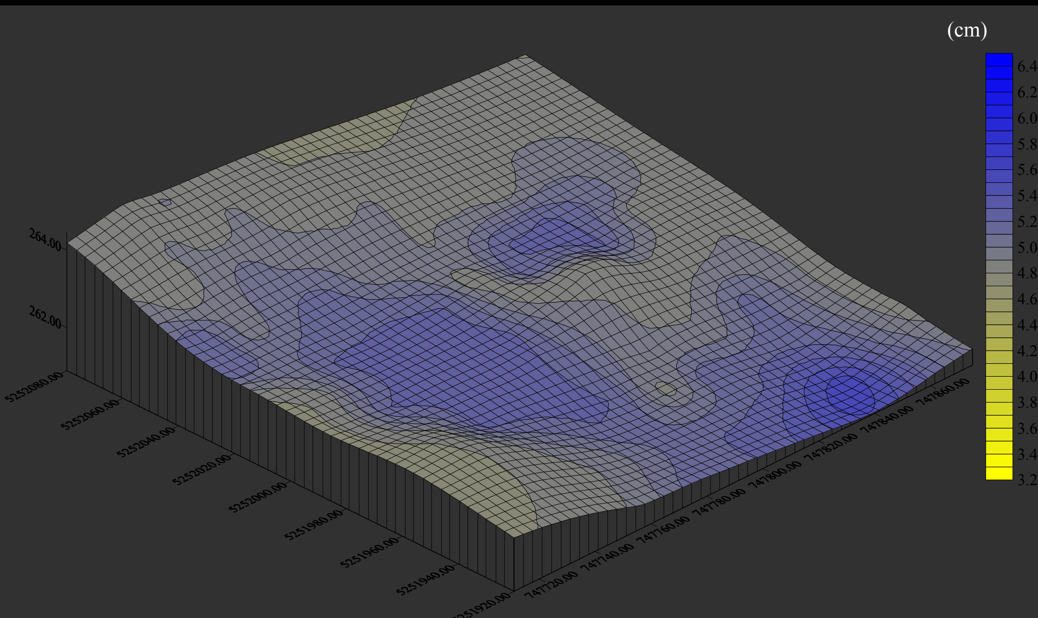


Dual criteria optimization through tested model determines the N rate that minimizes nitrate leaching and increases net revenues for farmers

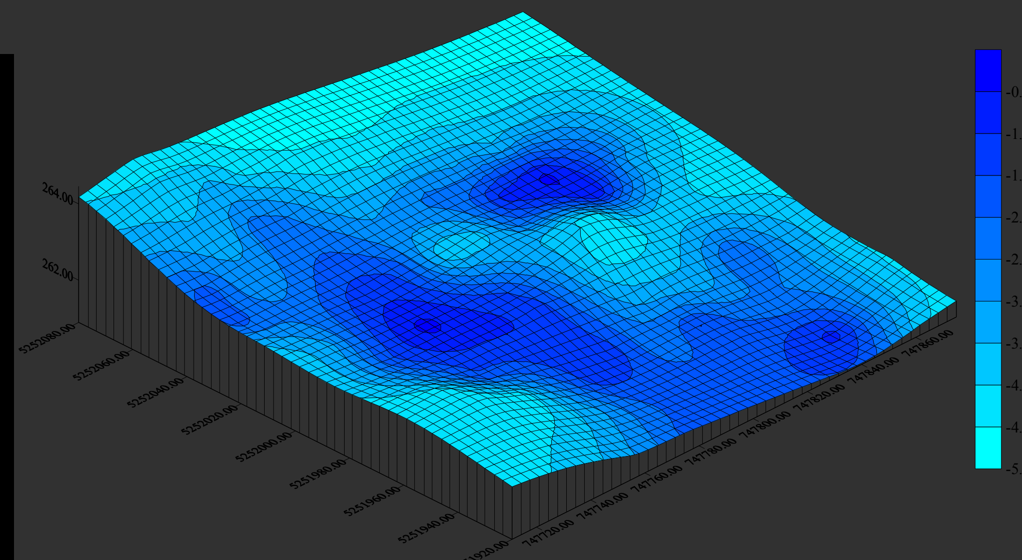
(Basso et al., 2011; Eur J. Agron 35:215–222)

Accounting for spatially connected processes

Soil water content 0-30 cm



SALUS-TERRAE



Net surface flow (Runon-Runoff)

Adaptation strategies

Economic and Agronomic Strategies will play an important role to reduce cost and increase profits due to climate variability

Agronomic strategies

- **Short-term adaptation** - Need to be coupled with weather forecast
  - conserve more water in the soil, through conservation practices, variable rate irrigation, changing planting date)

- **Long-term adaptation** – Change cropping systems, increase biodeversity on the farm, rotation, adopt new cultivats, microclimate modifications

Precision agricultural management as adaptation and mitigation strategies

Precision Agriculture Strategies reduce risks and allows the stabilization of ecosystems services for the following reasons:

- Gains in energy efficiency for farm operations that consume fuel, including mechanical operation such tillage, irrigation, fertilization etc..
- Gains in production or yield efficiency for grain, and other agricultural products
- Abetment of the GHC emission (N_2O) by better fertilizer use

Conclusions

- The choices we make today in how we use land and water resources will have enormous consequences on the future sustainability of earth's ecosystems and the services they provide.
- Food production to increase by ~70 % by 2050 to eradicate hunger on a planet with ~9 billion people (IIASTD 2009)
- Most of the production growth must occur in countries where it is consumed, including in marginal areas where many of the poor reside
- 75% of future growth must come from lands already in use - limited potential for land expansions, except in the Americas and Sub-Saharan Africa
- Manage the rainfall we get- Irrigation expansion may be crucial to meeting food demand