Chapter 2 - Methodology

The study region is immense and represents about 30% of the land area of Australia (Map 1.1). Discussions with stakeholders showed that there was a great diversity of opinion on terms of reference for a scoping study. While there was agreement on the broad topic areas to be included the priority given to selected topic areas varied considerably, some are listed below:

- Identifying potential growing areas and the specific land and water resources available in different regions.
- Detailed regional reviews with emphasis on biodiversity and flora and fauna surveys.
- A review of past cotton research by region, including other information relevant to cotton.
- Must at least include all geohydrological and soil surveys collected within the study area.
- The document needs to be of sufficient detail that it provides an information resource capable of identifying R&D needs across all disciplines.

Clearly it was impossible to meet all the above criteria within the timeframe available. Thus the approach taken in Chapters 4, 5 and 6 is to review issues on a State basis. Within each State issues relating to the four regions where there is cotton research, namely Broome, the Ord River, Katherine-Daly Basin and Richmond, are considered in greatest detail. For these regions reviews are made of past cotton and other relevant research and development, climatic potential, soil and water resource data, infrastructure and key environmental and community issues. Across WA, NT and NQ a further 17 regions/sub-catchments that may have potential to grow cotton are reviewed using the same broad headings but at a level of detail sufficient to flesh out the key issues and provide guidance for future region specific research and development needs.

Chapters 3 and 7 are written to incorporate issues not included in the regional reviews. Chapter 3 briefly reviews past attempts at large-scale agricultural development in northern Australia and makes recommendations on successful research and development processes. Chapter 7 integrates the specific issues arising from the regional reviews and identifies global issues and common R&D philosophies.

The climatic potential for cotton growing is assessed for 19 locations in northern Australia, representing the majority of the potential growing regions reviewed. The rainfall pattern must be such that sowing and picking operations can be conducted with minimal risk of exposure to excessive rainfall. In northern Australia, the transition from the wet to the dry and dry to wet seasons are periods of high rainfall variability (Mollah 1986). The seasonal transitions have been shown to be important operationally for crops during the wet season in this region (Yeates *et al.* 1996, Yeates *et al.* 2000). The seasonal transitions will also be important in dry season cotton systems. The rainfall pattern during season transitions will impact upon trafficability, crop establishment, early season weed control and possibly insect pest pressure. Rain on mature cotton will discolour lint and significant price discounts can accrue. In addition, in environments where temperatures are warm during picking, as is the case in northern Australia, harvest rain can stimulate rapid regrowth after defoliation and this will also interfere with harvest operations and reduce lint quality.

Climatic data, except for Katherine and Kununurra, is obtained from the SILO database and included the period where temperature records were best, (>1956). Degree Day Sums with a base temperature of 12°C (DDS_{12}) are calculated using the method of Constable and Shaw (1988). Calculations of DDS_{12} and frequency of sub-optimal night temperatures (< 11°C or 12 °C) are made using the program SAS (1993).

The OZCOT-APSIM (1_55) yield simulation model (Hearn 1994, McCown *et al.* 1996) is used to calculate potential yields for different sites across northern Australia. A Cununurra clay characterised at the Ord River Irrigation Area (Yeates unpublished data) is used for all locations with a similar black soil. This assumption is consistent with soil surveys at WA, NT and Gulf of Carpentaria sites (Kinhill Pty Ltd 2000, Stewart *et al.* 1970, Speck *et al.* 1964, Christian *et al.*1952). Locations with sandy textured soils having a high hydraulic conductivity were characterised as Blain Sandy Loam, which occurs in the NT (Williams *et al.* 1985). This assumption is also consistent with soil survey results (e.g., Cotching *et al.* 1990). Locations with red earth soils are characterised as the Tippera Clay Loam found at Katherine (Carberry *et al.* 1996; Yeates and Imrie 1993). At Mareeba, a Kraznozem soil characterised for maize at Kari is used (P. Poulton, CSIRO, Toowoomba, Qld, unpublished data).

Crop management inputs to simulations are:

- A plant density of 10 p/m2 using a late maturing variety.
- An adequate but not luxurious rate of N fertilisers of 200 or 230 kg N/ha on clay and earth/sandy soils respectively.
- Starting soil available nitrogen values are typical of these soils under cropping at 65 and 30 kg N/ha for black and sandy soils respectively.
- Irrigation water is applied by drip and furrow on sandy and black soils respectively.
- On black soils it is assumed the soil water content is returned to saturation following irrigation.