Caribou maintained the willow and herbaceous diet until they departed the calving ground near the end of June. Because climate warming and earlier greening may increase the carbon:nitrogen ratios of individual forage species and reduce their quality on fixed dates (Walsh et al. 1997), rapid shifting among forage species may allow caribou to accommodate time-specific reduction in nutritional quality of individual plant species that accompanies climate warming.

Diet of Porcupine herd caribou was substantially different when they used the Canadian portion of the extent of calving than when they used the Arctic Refuge coastal plain and the 1002 Area. Regardless of timing of snowmelt in Canada, calving diet there was dominated by mosses and evergreen shrubs (58.4-73.5%, Russell et al. 1993). These forage groups were much less digestible than the immature cottongrass flowers and willows (Russell et al. 1993) that dominated the calving diet of the Porcupine caribou herd in 1993 and 1994. This implied that diet quality during calving was reduced when the Porcupine caribou herd used the Canadian portion of the extent of calving rather than the Arctic Refuge coastal plain and the 1002 Area.

Habitat Selection

Habitat selection may be assessed at several orders (Johnson 1980); selection at each order implies disproportionate use of some component(s) of the habitats that are available. For migratory barren-ground caribou, selection orders might be defined as follows from highest to lowest order:

First Order – the species distribution on earth.
Second Order – area use by herds within the species range.
Third Order – annual range use within herd ranges.
Fourth Order – seasonal range use within annual ranges of herds.
Fifth Order – annual use within the aggregate extent of a seasonal range.
Sixth Order – annual concentrated use within an annual seasonal range.
Seventh Order – patch use within a concentrated use area.
Eighth Order – plant species use within habitat patches.
Ninth Order – plant part use within plant species.

Higher order selection may constrain the choices at lower orders (Johnson 1980). The basis of selection may or may not be consistent among orders and, when the basis of selection changes among orders, habitat selection is considered to be scale-dependent (O'Neil and King 1998). In this work, we assessed habitat selection at fifth and sixth orders as defined above. Much discussion has focused on fourth order selection (cf. Bergerud and Page 1987; Fryxell 1991, 1995), but analysis of selection at the fourth order for the Porcupine caribou herd was beyond the scope of this report.

For the purposes of the material that follows, we define *fifth order selection* as the comparison of use within the annual calving grounds (ACG) to availability in the extent of calving (EC), written as ACG/EC (hereafter called *calving ground selection*). We define *sixth order selection* as the comparison of use within annual concentrated calving areas (CCA) to habitat availability within the annual calving grounds (CCA/ACG, hereafter called *concentrated calving selection*).

Because there was spatial dependency among habitats (vegetation, NDVI estimates, snowcover; all inventoried from the same 1-km^2 pixels) we present the results for each habitat attribute separately. Selection was assessed by comparing mean use/availability ratios among years with the null use/availability ratio of 1.0.

Habitat conditions within the extent of calving have been variable during 1985-2001. There was substantial snowcover throughout the extent of calving in 1986, 2000, and 2001, but greening was early in 1990, 1994, 1995, and 1998 (Fig. 3.18).

There was scale dependency in habitat selection by the Porcupine caribou herd during calving. Parturient females selected annual calving grounds with proportionately greater area of high (>median) rate of greening (NDVI_rate, 1.33x, P=0.005) (Fig. 3.19*a*) and proportionately less area with high forage biomass both at calving (NDVI_calving, 0.60x, P< 0.001) (Fig. 3.19*f*) and during peak lactation demand (NDVI_621, 0.70x, P=0.002) (Fig. 3.19*c*) than available in the extent of calving.

Parturient females also selected annual calving grounds with proportionately more area in the 26-50% (1.76x, P= 0.001) and 51-75% (1.71x, P= 0.008) snowcover classes and proportionately less area in the 0-25% (0.84x, P= 0.008) snowcover class than available in the extent of calving (Fig. 3.20).

Analysis of vegetation types in annual calving grounds showed that parturient females selected wet sedge (1.42x, P= 0.004), herbaceous tussock tundra (1.42x, P< 0.001), and riparian (1.37x, P< 0.001) vegetation types, avoided the alpine vegetation type (0.60x, P< 0.001), and did not respond (P> 0.05) to the shrub tussock tundra or moist sedge vegetation types (Fig. 3.21).

In contrast, at the next lower selection order (sixth), parturient females of the Porcupine caribou herd selected concentrated calving areas with proportionately greater area of high forage biomass both at calving (NDVI_calving, 2.35x, P< 0.001) (Fig. 3.19*f*) and during peak lactation demand (NDVI_621, 2.59x, P=0.001) (Fig 3.19*c*) than available in the annual calving grounds. The females were non-selective (P> 0.05) for rate of greening (NDVI_rate) (Fig. 3.19*a*) and all snowcover classes (Fig. 3.20), selected herbaceous tussock tundra

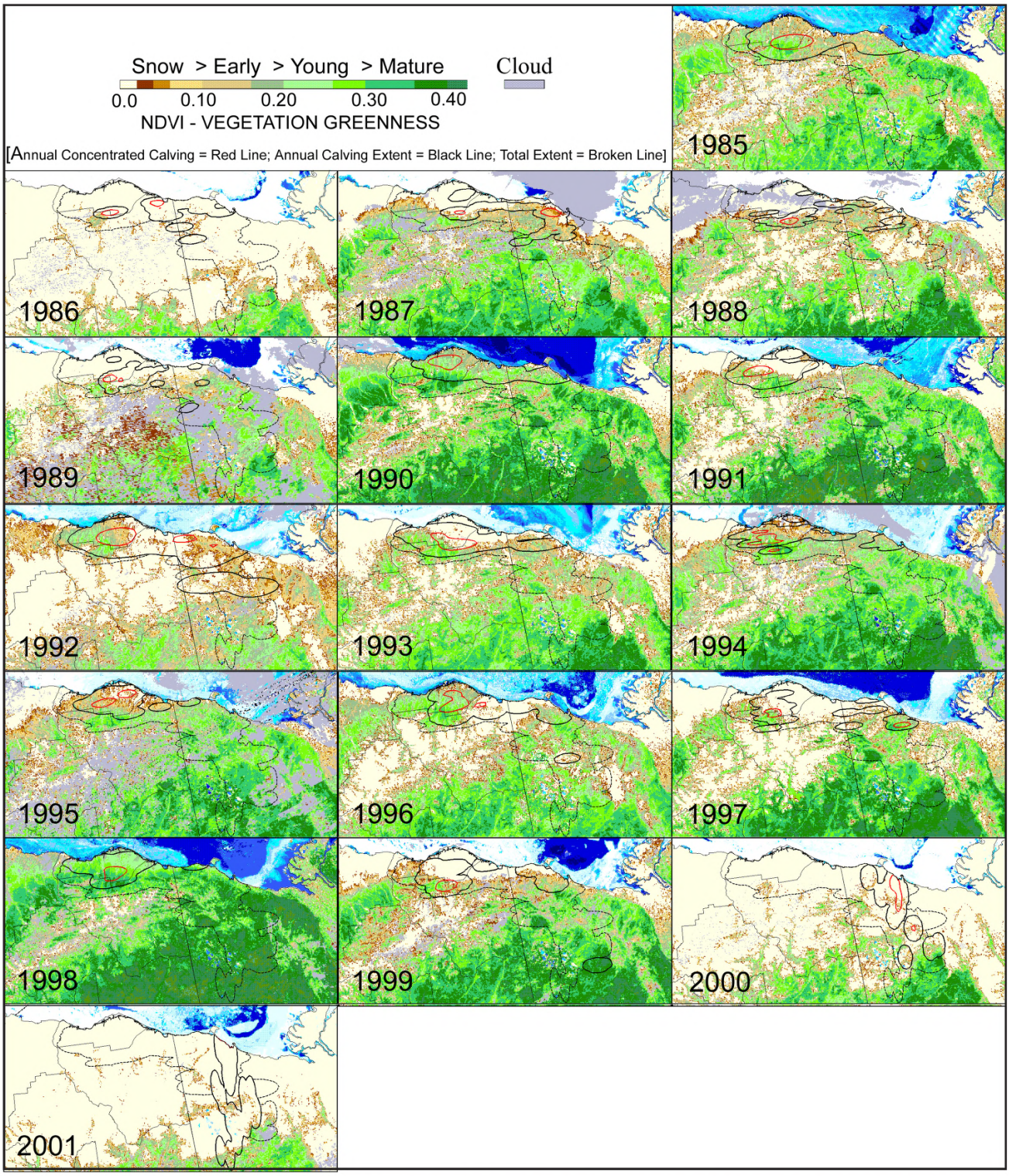

Figure 3.18. Annual conditions of snowcover and vegetation phenology derived from Advanced Very High Resolution Radiometer (AHVRR) satellite imagery during the calving period (30 May - 5 June), 1985-2001, for the Porcupine caribou herd. No concentrated calving was detected in 2001.