

family.py

This module sets up monkey family groups that move around the FNNR grid. For individual monkeys, see monkeys.py. Some lists that belong to monkeys.py can be found in here, since everything from families.py gets imported into monkeys.py anyway.

```
import: Agent from mesa.agent, random
```

set up: demographic structure list, recent infant death list (for mothers who have recently lost infants), random mother list (legacy list that addresses a rare glitch; model might work without it, should be investigated later), male_maingroup_list, female_list, reproductive_female_list, moved_list

```
class Family(Agent):
```

```
    initialize unique ID, model reference, current position, family size, list of family members, family_type, saved_position, split_flag (see model.py)
```

```
    define step() function:
```

```
        load vegetation dictionary to refer to
```

```
        if April or September of the current model year:
```

```
            travel towards Yangaoping 80% of the time; usually, family groups move about 5-10 grid pixels at a time, which represents about 1500-3000m every five days (note that monkeys can "double back" in direction)
            add movement coordinates to moved_list
            jump back towards center of FNNR if self.current_position ever wanders out of bounds (rare) or to an out-of range elevation
```

```
        elif right after April or September of the current model year:
```

```
            same as traveling towards Yangaoping, but in reverse direction to the rest of the reserve
```

```
        else: (not near mating season or if already in Yangaoping region)
```

```
            choose best direction to head in based on weighted-probability of neighbor choice from 8-cell neighborhood (diagonals and adjacents considered equally; choice is based on vegetation, elevation, and whether or not the cell is in human_avoidance_list from humans.py)
            add movement coordinates to moved_list (see humans.py)
            jump back towards center of FNNR if self.current_position ever wanders out of bounds (rare) or to an out-of range elevation
```

```
    define neighbor_choice() function:
```

```
        assigns each 8-cell neighbor a vegetation based on weighted probability according to table below:
```

Vegetation	Probability
Elevation Out of Bound	0
Bamboo	0.8
Coniferous	1
Broadleaf	1
Mixed	1
Lichen	0.8
Deciduous	1
Shrublands	0.8
Clouds	Random (0-1)
Farmland	0
Household	0
Farm	0.05
PES	0.2
Forest*	0.3
Outside FNNR	0

*Forest refers to managed forest.

In other words, a neighboring grid coordinate with the assigned vegetation type ‘Bamboo’ is five times more likely to be stepped on by a monkey-family agent than a grid coordinate with the vegetation type ‘PES,’ though because there are eight options, no single direction has a strong pull except if the monkeys are coded to head towards or away from Yangaoping during mating season.

A list of the 8 neighboring probabilities is generated, and a random number is then chosen. For example, consider the following 8-neighbor-cell situation, where the middle/center cell represents the monkey’s current location:

Forest	Broadleaf	Broadleaf
Shrublands	Monkey	Broadleaf
Shrublands	Lichen	Outside FNNR

The code translates this visual grid into a list that represents this table:

0.3	1	1
0.8	Monkey	1
0.8	0.8	0

The list generated would be: [0.3, 1, 1, 0.8, 1, 0.8, 0.8, 0], and probabilities would be determined as any given cell’s probability divided by the total sum of that list (or the sum of all neighbors).

For example, according to this list, the chances of the monkey choosing to move south and enter the “Lichen” grid would be 0.8 (Lichen’s probability weight) divided by 5.7, the sum of the list generated, which is approximately 14.035%. The total probabilities of all neighbors should add up to 100%.