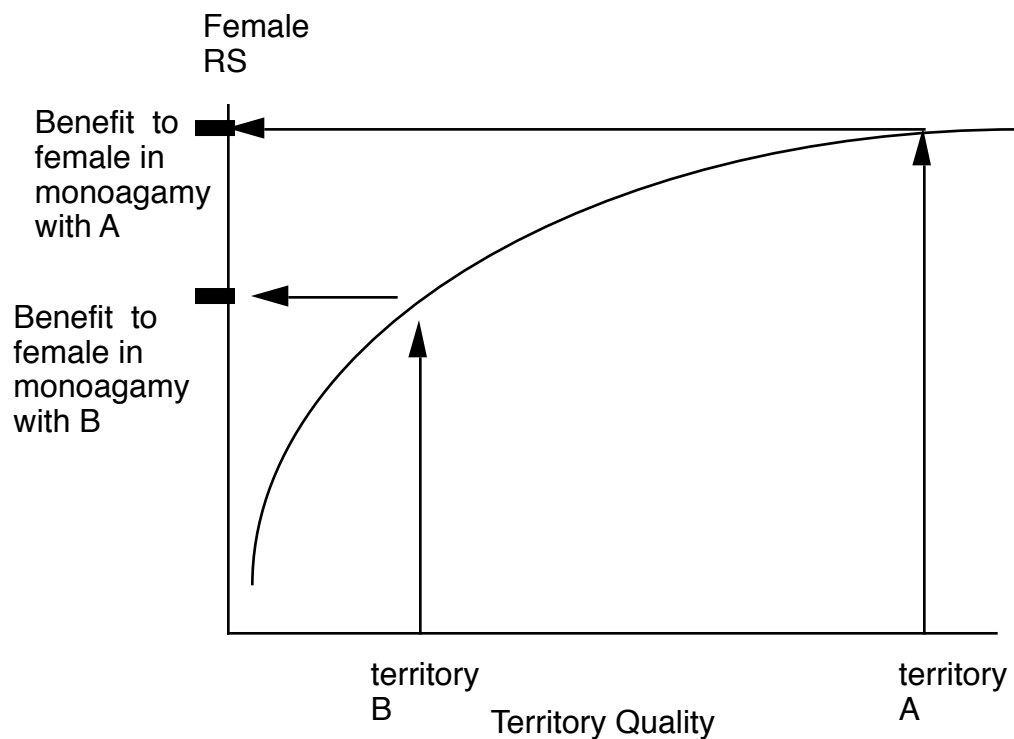


# A Polygyny Threshold Model<sup>1</sup>

Ethology and Behavioral Ecology

*This is an economic model that predicts when the non-territory holding sex should chose to mate with a territory holder who already has one or more mates. The result is a polygynous or polyandrous relationship, for the focal individual. The model seeks to identify the economic conditions where polygyny/polyandry is acceptable for the sex that does not hold the territory. Note that this model is clearly built from Brown's resource defense model (see Resource competition notes).*

## Territory quality and female RS

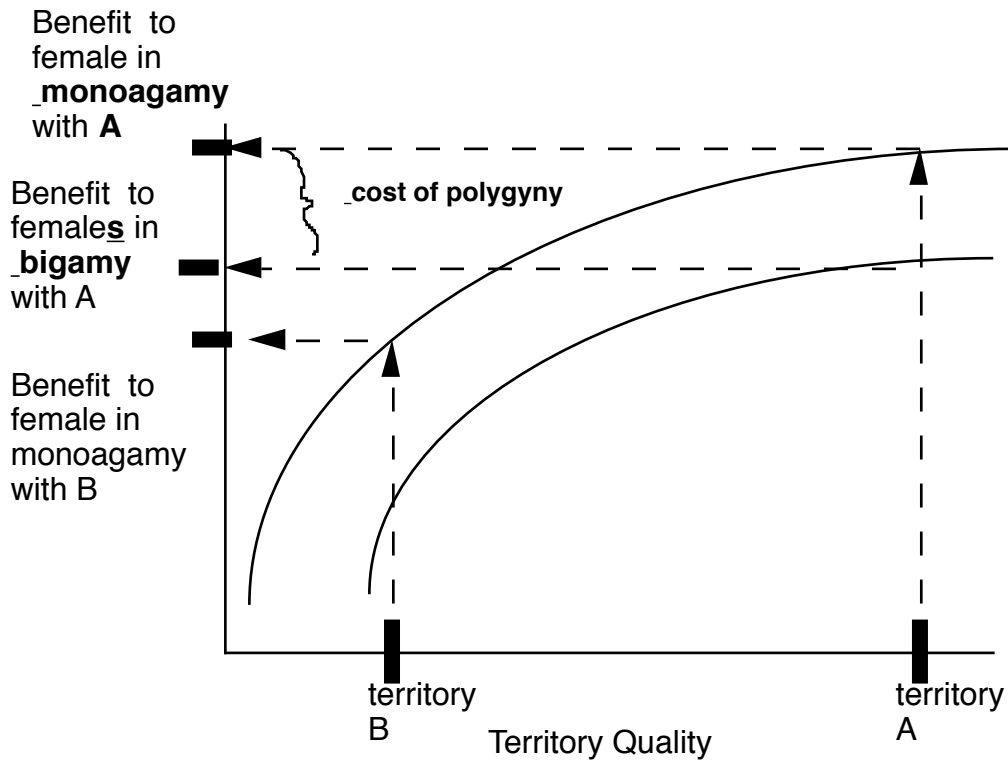


**Fig. 1:** This graph simply shows that territories that differ in quality and that are held by different males (A and B) result in different RS for the females that settle into monogamous relationships with these males. Thus, the x axis represents all possible territory qualities and the plot is a function that relates these territories to female success when the relationships are monogamous

<sup>1</sup> References: Orians, G.H., 1969. On the evolution of mating systems in birds and mammals. *Am. Nat.* 103, 589 - 603

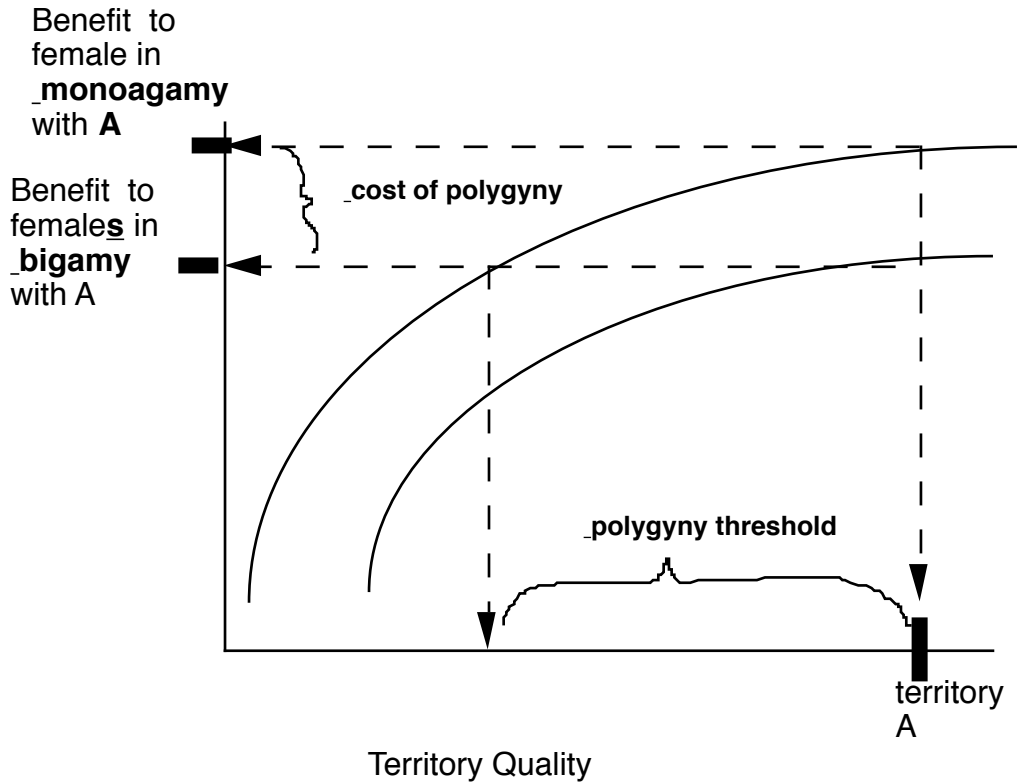
Verner, J., Willson, M.F., 1966. The influence of habitats on mating systems of North American passerine birds. *Ecology* 47, 143 - 147

## The cost of polygyny



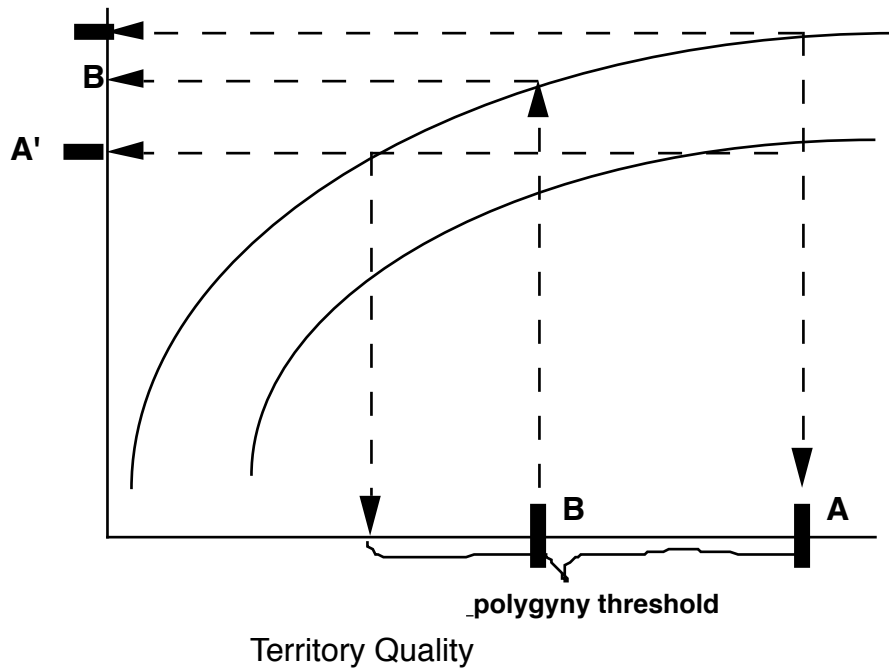
**Fig. 2: A second curve represents the depression of average female RS when they enter into bigamous polygynous relationships. Thus a female who chooses polygyny with A sees her fitness lowered. The difference between the fitness in monogamy (from top curve) and polygyny (bottom curve) is the cost of polygyny. A similar cost would be paid by a second mate for male B**

## The Relationship between the cost of polygyny and the polygyny threshold



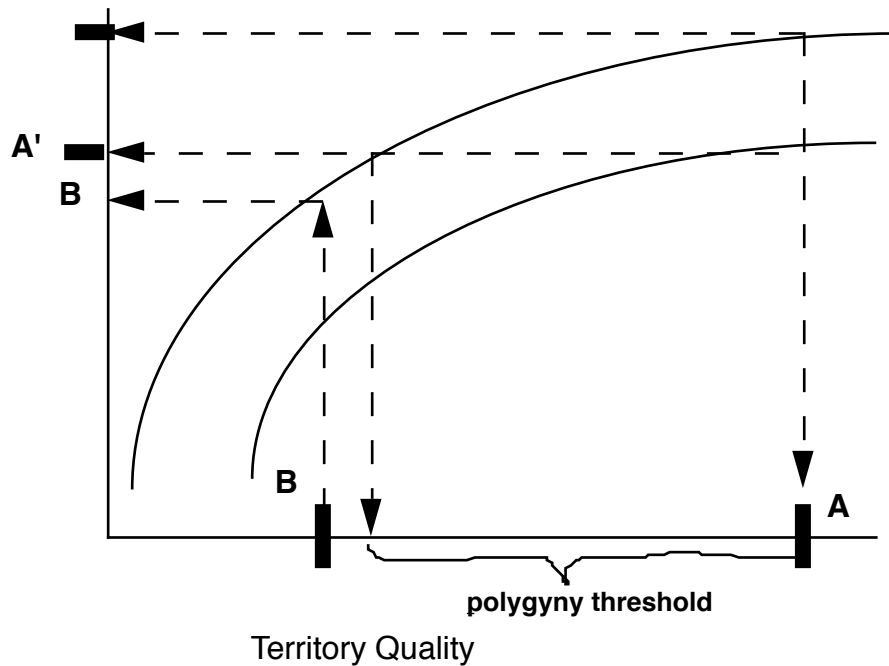
**Fig. 3:** If we now see determine the decrease in territory quality that would cause a decrease in female fitness equal to the cost of polygyny we can define this quantity as the polygyny threshold. Notice that for a choice between polygyny (lower line) and monogamy on a poorer territory (upper line) the polygyny threshold is the minimum change in territory difference that will cause a female to favor polygyn over monogamy. This is illustrated in the next two figures.

**Territory Difference is less than the polygyny threshold -- choose monogamy**



**Fig. 4: Here we see a choice between territories A and B. Assume that the male with territory A already has a mate. A second female that chooses A will get reward A'. By contrast, if she chooses monogamy with B (the owner of the overall poorer territory, she comes out ahead and therefore she should chose B. Notice that the difference in quality between territory A and B is less than the polygyny threshold.**

Territory diff. is greater than the polygyny threshold -- choose polygyny



**Fig. 5: Once again a choice between territories A and B EXCEPT THAT THIS TIME THE DIFFERENCE BETWEEN THE QUALITY OF THE TERRITORY OWNED BY B AND A IS GREATER THAN THE POLYGYNY THRESHOLD. Again assume that the male with territory A already has a mate. A second female that chooses A (polygyny) will get reward A'. By contrast, if she chooses monogamy with B she gets reward B and comes out behind this time, since his territory is so much worse than A's. So, she will be better off to settle for polygyny.**